# *A STUDY OF THE EFFECTS OF RAW GARLIC AND GARLIC PEARLS ON LIPID LIPOPROTEIN PROFILE IN SUBJECTS OF HYPERCHOLESTEROLEMIA*

# THESIS

**FOR**

**DOCTOR OF MEDICINE**
**(MEDICINE)**



**BUNDELKHAND UNIVERSITY**
**JHANSI (U.P.)**

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**2003** **SHARAD CHANDUKA**

*Dedicated to*
*my*
*Grand Parents*

**Department of Medicine,**
**M.L.B. Medical College,**
**Jhansi (U.P.)**

# *Certificate*

This is to certify that the work entitled '***A study of the effects of raw garlic and garlic pearls on lipid lipoprotein profile in subjects of hypercholesterolemia***' has been carried out by **Dr. Sharad Chanduka** in the Department of Medicine, M.L.B. Medical College, Jhansi.

He has put in the necessary stay in the department as per University regulations.

Dated :

**(DR. R.C. ARORA)**
**M.D, D.Sc.**
**Professor & Head,**
**Department of Medicine,**
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Sharad Chanduka.

*Dated* :

**(SHARAD CHANDUKA)**

# CONTENTS

# *Introduction*

# INTRODUCTION

Atherosclerosis is the leading cause of death and serious morbidity in the present human civilization. It is a progressive disease which begins in childhood and has manifestations in the middle to late adulthood.

Although any artery may be affected, the aorta, the coronary and the cerebral systems are the prime targets. Hence myocardial infarction, cerebral infarction and aortic aneurysms are the major consequences of this disease. Moreover, extensive atheromas are friable often yielding emboli of their grumous contents into the distal circulation (Atheroemboli) more commonly noted in the kidneys.

Other consequences of acutely or chronically diminished arterial perfusion are such as gangrene of the legs, mesenteric occlusion, chronic ischemic heart disease, ischemic encephelopathy and sudden cardiac death.

Hyperlipidemia, hypertension, cigarette smoking and diabetes are the most significant risk factors for atherosclerosis. The direct relationship between total serum cholesterol and the incidence of coronary artery disease (CAD) has been well established by Framingham study. Abnormalities in plasma lipoproteins and

dearrangements in lipid metabolism are the most firmly established and best understood risk factor for atherosclerosis.

Classically, risk factors involved in the causation of atherosclerosis are divided into two categories :

i) Those modifiable by life style and/or pharmacotherapy.

ii) Those that are essentially unmodifiable (eg. age, male gender, genetics).

Garlic (Allium sativum L.) has come to be seen as an all round treatment for preventing atherosclerosis the cause of heart disease and strokes.

Garlic also appears to slightly improve hypertension, protect against free radicals and slow blood coagulation. Garlic has also been proposed as a treatment for asthma, candida, colds and diabetes.

Garlic preparations have been found to slow hardening of the arteries in animals, reducing the size of plaque deposits by nearly 50%. It reduces serum cholesterol levels primarily by inhibiting cholesterol synthesis.

Both raw garlic and preparation of garlic act by similar mechanism which are related to the amount of garlic used and to

the mixture of multiple compounds from the sulfur containing class of thiosulfinates, ajoenes and dithins.

Five individual sulfur containing compounds in garlic are ajoene, methylajoene, allicin, 2-vinyl-4H-1,3 dithin and diallydisulphide inhibit cholesterol synthesis by 37%-42%.

Garlic contains an essential oil allicin ($C_6H_{10}S_{20}$) which contains allylpropyldisulphide, diallyldisulphide and several other sulfur compounds as mentioned above. It has also been found that garlic almost completely suppresses thromboxane B2 synthesis.

Garlic inhibits platelet aggregation by alteration in both the platelet cyclooxygenase and lipooxygenase pathway. Work be Apitz Castro et al suggests that garlic inhibitory effect might be mediated through modification of the physiochemical properties of the plasma membrane, rather than by affecting the arachidonic or calcium metabolism of platelets.

Studies by Ariga et al have been shown that garlic extract which inhibit platelet aggregation by suppressing thromboxane synthesis is to be as methyl allyl trisuphide (MATS).

Garlic has also been found that it increases fibrinolytic activity. The precise mechanism(s) remain to be defined.

Many studies have found that certain forms of garlic can lower total cholesterol levels by about 9-12%[23]. Although similar studies conducted at various parts of the worlds did not show any significant change in cholesterol levels by use of garlic[1, 6, 26, 35, 36].

Bordia et al[2-4] have claimed that acute ingestion of garlic in healthy subjects will prevent fat induced changes in blood lipids, coagulation and fibrinolysis and they claimed it superior to clofibrate. Later Sainani et al[5] confirmed the reported beneficial effects of garlic.

Henceforth promoters of essential oil extracts of garlic known as "Garlic pearls" (each capsule containing 0.625mg of garlic oil i.e. garlic oil 0.25%w/w excipients qs to 250mg) advertise their efficacy in reducing serum cholesterol and in preventing heart disease.

Although study conducted by Arora et al (1981)[6] at department of Medicine, M.L.B. Medical College, Jhansi have demonstrated that garlic did not cause any significant change in serum cholesterol values and does not substantiate the efficacy of garlic in the management of IHD as a hypocholesterolemic or as a fibrinolytic agent.

Lipid lowering drugs such as statins are an exciting advance, they decrease hepatic cholesterol synthesis by inhibiting HMGCoA

reductase. They are highly effective in reducing total & LDL cholesterol, they usually increase HDL cholesterol. Long term efficacy and safety has been established.

A number of angiographic trials using statin monotherapy have been performed such as multicentre anti atheroma study (MAAS), multicenter coronary intervention study (CIS) that uniformly demonstrated significnat improvement in the lipid profile with simvastatin plus diet therapy as compared with the changes induced by dietary intervention alone.

Scandinavian simvastatin survival study (4S) evaluated that simvastatin therapy resulted in a significant beneficial alteration of the lipid profile.

Therefore we, decided to re evaluate the effect of raw garlic and essential oil extracts of garlic on lipid lipoprotein profile in subjects of hypercholesterolemia and to compare the effect with that of the well known hypolipidemic drug simvastatin. The effect of withdrawal was also studied.

# *Review of Literature*

# REVIEW OF LITERATURE

Atherosclerosis is the leading cause of death and disability. It affects the various regions of the circulation and yields distinct clinical manifestations depending on the circulatory bed affected. Atherosclerosis is responsible for coronary artery disease, cerebrovascular disease, peripheral occlusive diseases and aortic aneurysm.

Atherosclerosis is a disease primarily of the elastic arteries preferentially large and medium sized muscular arteries. The basic lession is the atheroma or fibrofatty plaque which consists of a raised focal plaque within the intima, having a core of lipid (mainly cholesterol and cholesterol esters) and a covering fibrous cap. (Robbins & Cotran, 1994). Various risk factors for atherosclerosis are present of them four are most significant i.e.

- Diet and hyperlipidemia (hypercholesterolemia, hypertriglyceridemia).
- Hypertension
- Cigarette smoking
- Diabetes

Others are obesity, physical inactivity, stress (type A personality), male gender, hyperhomocysteinemia etc.

Atherosclerotic plaques are rich in cholesterol and cholesterol esters which are mainly derived from the lipoproteins present in the blood.

Genetic disorders causing severe hypercholesterolemia manifests as premature atherosclerosis despite the absence of other risk factors eg. (congenital absence of LDL receptros).

Acquired diseases that cause hypercholesterolemia such as nephrotic syndrome and hypothyroidism increase the risk of IHD.

The Framingham heart study has elucidated the relation between total cholesterol, LDL-C, HDL-C, triglyceride levels and the risk for coronary atherosclerosis. During the 12 years follow up evaluation a total of 383 men and 227 women developed symptomatic CHD and showed a significant positive correlation with the categories of blood pressure, total cholesterol, LDL-C and HDL-C.

Framingham heart study also evaluated the association between the elevated plasma Lp(a) and CHD in a prospective manner[13]. Lp(a) was determined to be an independent risk factors comparable

to the attributable risk of total serum cholesterol in excess of 240mg/dl or an HDL-C level of less than 35mg/dl.

## *Cholesterol :*

Cholesterol is an amphipathic lipid and as such is an essential structural component of membranes and of the outer layer of plasma lipoproteins. Lipoprotein transport free cholesterol in the circulation where it readily equilibrates with cholesterol in other lipoproteins and in membranes.

It is synthesized in many tissues from acetyl-CoA and is ultimately eliminated from the body in the bile as cholesterol or bile salts. Cholesterol is the precursor of corticosteroids, sex hormones, bile acids and vitamin D.

It occurs in foods of animal origin such as egg yolk meat, liver and brain and a major risk factor for atherosclerosis (Harper 1996).

## *Triglyceride :*

Triglyceride is synthesized from phosphatidate which in turn is synthesized from acylation of glycerol 3 phosphate by enzyme glycerol 3 phosphate acyl transferase. These are the major energy storing lipids (Harper 1996). Some studies have shown that plasma triglycerides levels >130-150mg/dl are associated with low HDL cholesterol and small dense LDL particles. Meta analysis of several

prospective population studies confirms that triglyceride concentrations are independent risk predictor of coronary heart disease.

## *Lipoproteins :*

Lipoproteins are spherical particles made up of hundreds of lipid and protein molecules. The major lipids of the lipoproteinhs are cholesterol, triglycerides and phospholipids. Triglycerides and cholesterol esters (esterified form of cholesterol) are hydrophobic and forms the core of the lipoprotein.

Phospholipids and a small quantity free (unesterified) cholesterol are amphipathic and cover the surface of the particle. According to the density lipoproteins of plasma have been grouped into four groups. As the proportion of lipid to protein in a lipoprotein increases, the density decreases. According to increase of density they are classified as follows :

**Table No.1**

Multiple studies have revealed that there is an inverse relationship between the HDL level and the risk of coronary events. HDL helps in reverse cholesterol transport from the tissue back to liver.

## Table No : 1

## Compositions of the lipoproteins in plasma of humans :

| Fraction | Source | Density | Composition | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Protein (%) | Total lipid (%) | Percentages of total lipid | | | | |
| | | | | | Triacylglyceride | Phospo-Lipid | Cholesteryl ester | Cholesterol (Free) | Free Fatty acid |
| Chylomicrons | Intestine | <0.95 | 1-2 | 98-99 | 88 | 8 | 3 | 1 | - |
| VLDL | Liver (Intestine) | 0.95-1.006 | 7-10 | 90-93 | 56 | 20 | 15 | 8 | 1 |
| IDL | VLDL | 1.006-1.019 | 11 | 89 | 29 | 26 | 34 | 9 | 1 |
| LDL | VLDL | 1.019-1.063 | 21 | 79 | 13 | 28 | 48 | 10 | 1 |
| HDL2 | Liver & Intestine VLDL, Chylomirons | 1.063-1.125 | 33 | 67 | 16 | 43 | 31 | 10 | - |
| HDL3 | | 1.125-1.210 | 57 | 43 | 13 | 46 | 29 | 6 | 6 |
| Albumin FFA | Adipose tissue | >1.281 | 99 | 1 | 0 | 0 | 0 | 0 | 100 |

VLDL – Very low density lipoprotein, LDL – Low density lipoprotein

IDL – Intermediate density lipoprotein, HDL – High density lipoprotein

## *Apolipoproteins :*

The protein moiety of a lipoprotein is know as an apolipoprotein. The apolipoproteins (apos) provide structural stability to the lipoproteins and determine the metabolic fate of the particles upon which they reside.

**Apolipoproteins of human plasma lipoproteins (Table No – 2)**

| Apolipoprotein | Lipoprotein | Metabolic Functions |
|---|---|---|
| Apo AI | HDL, Chylomicrons | Structural component of HDL, LCAT activator |
| Apo AII | HDL, Chylomicrons | Unknown |
| Apo IV | HDL, Chylomicrons | Unknown, possibly facilitates transfer of other apos between HDL and Chylomicrons |
| Apo B48 | Chylomicrons | Necessary for assembly an secretion of chyylomicrones from the small intestine |
| Apo B100 | Chylomicrons, VLDL, IDL, LDL | Necessary for secretion of VLDL from liver, ligand for LDL receptor |
| Apo CI | Chylomicrons, VLDL, IDL, HDL | May inhibit hepatic uptake of chylomicron and VLDL remnants |
| Apo CII | Chylomicrons, VLDL, IDL, HDL | Activator –lipoprotein Lipase |
| Apo CIII | Chylomicrons, VLDL, IDL, HDL | Inhibitor of lipoprotein Lipase, may inhibit hepatic uptake of chylomicron and VLDL remnants |
| Apo E | Chylomicrons, VLDL, IDL, HDL | Ligand for finding lipoprotein to LDL receptor. |

LCAT : Lecithin cholesterol acyl transferase.

According to the National Cholesterol Education Programme (NCEP) expert panel on detection, evaluation and treatment of high Blood Cholesterol in adults (Adult treatment Panel III). Major risk factors (exclusive of LDL cholesterol) for CHD are as follows:

- Cigarette smoking
- Hypertension (blood pressure ≥140/90mm of Hg or on antihypertensive medication).
- Family history of premature CHD (CHD in male first degree relative <55 yrs; CHD in female first degree relative <65 years).
- Age (men ≥45 years; women ≥55 years).

Diabetes is regarded as a coronary heart disease risk equivalent i.e. a condition that carries an absolute risk for developing new CHD equal to the risk for having recurrent CHD events in persons with established CHD.

Hence forth, hypercholesterolemia and hypertriglyceridemia are considered as directly and indirectly predisposing factors for ischemic heart disease and it is presumed that garlic may be beneficial in the primary or secondary prevention.

## *Garlic (Allium Sativum) :*

Garlic (Allium Sativum family Liliaceae) is widely distributed and used in all parts of the world as spice and food. Garlic is a dietary supplement regarded simultaneously as a food and a medicinal herb and has been used as such from the times of Egyptians Pharoahs and the earliest of chinese dynasties.

More than 1000 papers have been published in the past 20 years on garlic and related alliums. Garlic was called "Russian penicillin" during world war II because garlic were used to prevent wound infections.

Garlic exhibits potentially beneficial clinical activity as an antihyperlipidemic, antimicrobial, antiplatelet, antioxidant, antidiabetic and as a vasoprotective agent. Extensive clinical and scientific studies partially support the use of garlic for the treatment of hypercholesterolemia, infection and the prevention of atherosclerosis. Garlic also appears to slightly improve hypertention, protect against free radicals and slow blood coagulation.

Regular use of garlic may prevent cancer although it has been stated that garlic raises immunity but no real evidence is present to support the view. It has also been proposed as a treatment for asthma, candida and colds.

## *Mechanism of action*

Garlic is composed of many natural sulfur compounds including a sulfur containing amino acid alliin (S-allyl-L-cysteine sulfoxide). Alliin is pharmacologically inactive. When garlic is crushed, alliin mixes with the enzyme alliinase it is converted to allicin (diallyl thiosulfinate). Allicin is unstable and upon steam distillation or maceration yields various diallyl and dimethyl sulphides plus E-ajoene and Z-ajoene.

The total activity of garlic is in its ability to produce allicin, which then produces other active principles which is referred to as the allicin yield.

## *Hypocholeserolemic action :*

Garlic and wild garlic reduces serum cholesterol levels primarily by inhibiting cholesterol synthesis. Allicin sulfhydryl binding ability explains its cholesterol lowering effect as sulfhydryl containing compounds are involved in the synthesis of cholesterol. Sulfide bridges are formed by the disulfides found in garlic with 3-hydroxy-3methyl glutaryl CoA (HMG-CoA) reductase or the molecules found in lipids. HMG-CoA reductase is the rate limiting step in the synthesis of cholesterol as it catalyzes the intermediate step i.e. the formation of mevalonate from acetyl –CoA. Therefore,

allicin is commonly accepted as the pharmacologically active component in garlic.

## *ANTIPLATELET ACTION*

Makheja et al has shown that garlic extract inhibits platelet aggregation, by suppressing thromboxane β2 synthesis. Garlic inhibits platelet aggregation by alteration in both the platelet cyclooxygenase and lipooxygenase pathway.

Ariga et al have isolated the component as methyl allyl trisulphite (MATS).

Apitz Castro et al suggested that garlic's inhibitory effect might be mediated through modification of the physiochemical properties of the plasma membrane, rather than affecting the arachidonic or calcium metabolism of platelets.

## *VASOPROTECTIVE EFFECT*

Garlic's vasoprotective effect was demonstrated due to increased nitric oxide synthetase activity, which may facilitate endothelium dependent smooth muscle relaxation. Thus, garlic may improve aortic elasticity through restoration of impaired endothelium. Although other studies suggest that garlic also increases fibrinolytic activity.

In contrary to the common belief study conducted by Arora RC et al 1981 at Dept. of Medicine, M.L.B. Medical College, Jhansi showed that after 12 wks of intake of garlic, patients did not show any appreciable change in plasma fibrinogen levels or coagulation time.

## ***HYPOGLYCEMIC ACTION***

Garlic decreases blood glucose levels by increasing serum insulin and glycogen storage in liver.

The health benefits of garlic supplements remain a controversial topic. On one hand there appear to be quite a large number of studies indicating a beneficial cardiovascular effect of garlic supplements, on the other hand the most well controlled studies generally suggest a lack of any beneficial effect of garlic supplements.

(**Bordia, et al 1974-75**)[2-4] have claimed that acute ingestion of garlic in healthy subjects will prevent fat induced changes of blood lipids, coagulation and fibrinolysis. Study was only of 10 cases and they were so impressed by the results that they proceeded to assess the effect of garlic on experimental atherosclerosis in cholesterol fed rabbits and found it superior to clofibrate.

Later (**Sainani et al, 1979**)[5] study on 5 subjects confirmed the beneficial effects of garlic, as showed by Bordia et al. Moreover they concluded that garlic and onion would result in significantly lowered ($p<0.0001$) levels of serum cholesterol, serum triglyceride and β–lipoprotein (LDL).

(**Arora RC, Arora S et al, 1981**)[1] evaluated the effect of essential oil extracts of garlic and onion in the doses recommended by these authors.

Twenty healthy males (age 26.4±5.12 yrs, weight 56.7±7.3Kg) and 13 proven cases of IHD (age 43.8±9.5 yrs, weight 64.9±8.2Kg) were randomly chosen from patients attending MLB Medical Medical College & Hospital, Jhansi. and were given fat rich diet, fat rich diet + clofibrate, fat rich diet +garlic, fat rich diet +onion. The fasting & post prandial values of serum cholesterol and b-lipoprotein thus obtained in different test conditions did not show any appreciably change. Henceforth the so called beneficial effects of garlic and onion were not seen.

(**Arora RC, Arora S, Gupta RK et al, 1981**)[6] undertook another study were garlic was given (a) for long period and (b) without fat induced hyperlimia.

This study comprised of 30 proven cases of IHD (Gr I, 26 males and 4 females, age 41.0±3.7yrs) and 20 healthy volunteers

(Gr II, 18 males and 2 females, age 24.0±4.1 yrs). Subjects were given essential oil of garlic i.e. six garlic capsules (each capsule containing 0.625mg of garlic oil) in 3 equally divided doses at meals for a period of 12 weeks. The STC, STG, β–lipoprotein and plasma fibrinogen and coagulation time values showed marginal fluctuations with insignificant 'P' values.

(**Lau et al, 1987**)[14] conducted a study on 15 hyperlipidemic subjects they were treated with Kyolic aqueous garlic extract 1000 (4ml) daily for 24 weeks and 12 subjects were kept as control. Garlic significantly lowered cholesterol levels by about 9%.

(**Vorberg & Schneider et al, 1990**)[15] conducted a trial in Germany over a 40 hypercholesterolemic subjects and they were counselled to take Kwai Tablets 900mg/day for 16 weeks. Garlic extract significantly lowered blood cholesterol >12%. Explanation of the large effect in this study was that there was less heterogenicity between the participants. Secondly this study used the highest daily and cumulative dose of garlic. It was estimated that the Kwai trials tested the equivalent of approximately one half to one clove fresh garlic per day.

(**Mader et al, 1990**)[16] conducted a study in Germany. A total of 261 patients at 30 medical centers were given kwai tables (dried garlic extract) 800mg/day or placebo over the course of 16 weeks,

patients in the treated group experienced a 12% drop in total cholesterol and a 17% decrease in triglyceride levels. Patients who were having initial cholesterol levels of 250-300 mg/dl achieved maximum benefit. This study is considered to be one of the best study.

In the same period of 1990, **(Auer et al)**[17] studied 47 subjects with hypertension average starting blood pressure of 171/100. Over a period of 12 weeks, half were treated with 600mg of garlic powder daily standardized to 1.3% alliin, the other half was given placebo. Results showed statistically significant drop of 11% drop in systolic blood pressure and 13% in diastolic pressure.

Review article- **A meta analysis effect of garlic on total serum cholesterol was published in Ann Intern. Med 1993 by Stephen Warschafsky, et al**[23], showed that garlic in an amount approximating one half to one clove per day (600-900mg) has been shown to decrease total serum cholesterol by about 9%.

**A meta analysis published in the Journal of the Royal College of Physician by (Silagy CS, Neil HAW, et al, 1994)**[24] states that garlic supplements cause overall 12% reduction in total cholesterol over a placebo and it is evident after only 4 weeks, treatment and that this was likely to persist for as long as the study was continued.

**(Leon A Simons, Balasubramaniam S et al, 1995)**[26] conducted a trial over 30 subjects with mild to moderate hypercholesterolemia after a dietary restriction for 28 day, subjects took kwai® garlic powder tablets 300mg three times daily or matching placebo for 12 weeks, followed by 28 days washout, followed by a 12 weeks crossover on alternative preparation there was no significant differences in plama cholesterol, LDL-C, HDL-C, plasma triglycerides, Lp(a) concentration or blood pressure. This study clearly states against the findings of the previous meta-analysis.

**Neil HAW et al 1996** undertook a trial of 115 subjects for six months by a kwai® tablets 300mg three times daily and concluded that garlic is less effective for reducing serum cholesterol than suggested by his own meta analysis in 1994 and expected that previous reports may be a publication bias, overestimation of treatment effects in trials with inadequate concealment of treatment allocation.

Similarly **(Berthold HK et al, 1998)**[35] and **(Isaacsohn JL et al, 1998)**[36] showed that garlic oil preparation, garlic powder respectively had no influence on serum lipoprotein, cholesterol absorption or cholesterol synthesis.

**(Koscielny J et al 1999)**[28] a double blind placebo controlled study that followed 152 individuals for 4 years found that garlic significantly reduced the development of atherosclerosis.

Lipid lowering drugs such as statins are an exciting advance, they decrease hepatic cholesterol synthesis by inhibiting HMG-CoA reductase. They are highly effective in reducing serum total cholesterol, LDL-C and usually increase HDL cholesterol. Long term efficacy and safety of the drug has been established.

With the publication of the Landmark **Scandinavian Simvastatin survival study (4S) in 1994**, where 4444 patients were treated for an average of 5.4 years. Simvastatin became the first lipid lowering agent proven to reduce morbidity and mortality in patients with CHD, as well as safe in long use[50]. It showed that simvastatin improved patients survival by 30 percent and was well tolerated with a frequency of adverse events similar to those of placebo. Study was further reinforced by an eight year follow up of (4S) patients showing survival and safety were both continued[51].

Original 4S data have been reanalysed to demonstrate additional attributes of simvastatin in the secondary prevention of CHD.

- A reduction in the development of new or worsened angina pectoris by 26 percent[52].

- In patients with clinical diabetes, a significant decrease (42 percent) in the risk of major coronary events[53].
- In patients with impaired fasting glucose, a significant decrease (55 percent) in the risk of coronary mortality, total mortality (43 percent) and of major coronary events (38 percent)[53].

Simvastatin therapy resulted in a significant beneficial alteration of the lipid profile.

Patients were randomly assigned to receive either Placebo or 20mg of simvastatin per day. In the simvastatin group, total cholesterol was reduced by 28 percent, which was accompanied by a reduction in LDL-C levels of 38 percent. Simvastatin therapy resulted in 15 percent decrease in patients who had initial triglycerides levels were within the prescribed range of trial. Patients with significant hypertriglyceridemia before randomization had been excluded. HDL-C was increased by 8 percent.

Cerebrovascular events and new carotid bruits were also significantly reduced by simvastatin therapy.

# *Aims & Objectives*

# AIMS AND OBJECTIVES

1] To analyse the effect of raw garlic and garlic pearls on lipid lipoprotein profile in subjects of hypercholesterolemia when used as a food additive.

2] To analyse the effect of simvastatin on lipid lipoprotein profile in subjects of hypercholesterolemia when used as a drug.

3] To compare the results obtained from each study groups with other similar studies.

# *Material & Method*

# MATERIAL AND METHOD

The case material for the present study comprised of 30 subjects, out of which 3 subjects did not turned up after basal (registration), therefore total of 27 subjects are taken into consideration

The study was conducted in the department of Medicine, M.L.B. Medical College & Hospital, Jhansi. These subjects were selected form the patients attending the hypertension clinic, diabetic clinic, cardiac clinic, patients admitted in I.C.C.U. and wards of department of Medicine.

The study comprised of subjects who were hypercholesterolemic (>200mg/dl) or were having high serum triglyceride level (>200mg/dl) or both.

All the selected subjects were divided into 3 groups. Group A, Group B and Group C. Detailed information regarding the study was furnished to them and after that proper consent was taken. A total of 27 subjects were studied, 9 subjects in each group.

**Group A :** This group comprised of 9 subjects of which 7 were having hypercholesterolemia (>200mg/dl), 2 were having hypercholesterolemia as well as high serum triglyceride levels (>200mg/dl). This group comprised of 4 males and 5 females, age

50.5±10.6 years. Subjects under this group were counselled to take one clove of raw garlic per day for a period of 12 weeks with meal.

**Group B :** This group comprised of 9 subjects of which 6 were having hypercholesterolemia (>200mg/dl), 2 were having high serum triglyceride levels (>200mg/dl) and 1 was having both hypercholesterolemia and high serum triglyceride levels. This group comprised of 8 males and 1 female, age 49.7±9.8 years. Subjects under this group were counselled to take 4 garlic pearls (each capsule containing 0.625mg of garlic oil i.e. garlic oil 0.25%w/w excipients qs to 250mg) manufactured in India by Ranbaxy Laboratories Limited in 2 equally divided doses at meals for a period of 12 weeks.

**Group C :** This group comprised of 9 subjects of which 4 were having hypercholesterolemia and 5 were having both hypercholesterolemia and high serum triglyceride levels. This group comprised of 7 males and 2 females, age 48.3±10.4 years. Subjects under this group were counselled to take 20mg of simvastatin per day before evening meal for a period of 12 weeks.

## METHOD

Subjects were allowed to eat their usual diet and to lead their routine life. Subjects were advised to either reduce or to stop smoking. Similarly they were advised to either moderate or not to

use alcohol during this period. Drug compliance are assured by asking them on every visit about their drug intake.

Detailed history regarding the diseases and drug intake was taken which is followed by physical examination and routine investigation.

**DESIGN OF TEST :**

All the selected subjects of each groups were asked to have dinner on the previous evening and after an overnight fast of 12 hrs, fasting blood samples were collected and were instructed not to take anything except water during that period.

Five fasting samples of blood were collected from each subjects for lipid and lipoprotein analysis throughout the study.

One each at registration (Basal) any day during $4^{th}$ week, $12^{th}$ week while using raw garlic, garlic pearls and simvastatin in respective group.

Two samples out of five, were taken at $1^{st}$ and $3^{rd}$ month of the withdrawal of raw garlic, garlic pearls and simvastatin.

Serum was separated from blood within half an hour by centrifuging, and on the supernatant of the samples the following tests were done.

1. Serum total cholesterol (STC) estimation was done by enzymatic procedure of Allain and Koeschlau using cholesterol esterase, cholesterol oxidase and peroxidase in a single reagent.

   Estimation was done by one step method utilizing the kit provided by "Monozyme India Limited".

   Procedure :

   Three test tubes were taken and labelled as test(Tc), standard (s) and Blank (b) and then following steps were undertaken.

| | Test (Tc) | Standard (s) | Blank (b) |
|---|---|---|---|
| Enzyme reagent (1) | 1.0ml | 1.0ml | 1.0ml |
| Cholesterol standard (3) (200mg%) | | 0.01ml (10µl) | |
| Serum | 0.01ml (10µl) | | |
| Distilled water | 0.1ml | 0.1ml | 0.1ml |

   Contents of all the tubes were mixed well and then incubated at room temperature for 10 minutes.

   Optical density (O.D.) of each solution was measured against blank at 505nm (range 500-540nm). By blank calorimeter was set at zero and then calculation was done as follows:

$$\text{Total cholesterol/concentration of test sample (mg/dl)} = \frac{\text{O.D. of Tc}}{\text{O.D. of S}} \times 200$$

(Cholesterol 1mmol/L= 38.76mg/dl)

(Normal expected values <200 mg/dl)

2. Serum triglycerides (STG): It was estimated by enzymatic procedure of Bucolo and David modified by Trinder to a calorimetric test.

It was estimated by using GPO/POD method with ESPAS (N-Ethyl-N-Sulfopropyl-N-anisidine) utilizing the kit provided by 'Monozyme India Limited'.

Procedure:

Three test tubes were taken and labelled as test (T), standard (s) and blank (b) and then following steps were undertaken:

| | Test (T) | Standard (s) | Blank (b) |
|---|---|---|---|
| Enzyme reagent (1) | 1.0ml | 1.0ml | 1.0ml |
| Triglyceride standard (200mg%) | | 0.01ml (10µl) | |
| Serum | 0.01ml (10µl) | | |

Contents of all the tubes were mixed well and then incubated at room temperature for 15 minutes.

Optical density (O.D.) of each solution was measured against blank at 546nm (range 540-560). By blank calorimeter was set at zero and then calculation were done as follows.

$$\text{Serum triglyceride (mg/dl)} = \frac{\text{O.D. of T}}{\text{O.D. of S}} \times 200$$

(or conversion in mmol/l= mg/dl×0.0114mg/dl)

(normal expected value <150mg/dl)

3. High density lipoprotein cholesterol (HDL-c) was estimated by precipitating non HDL-c using phosphotungstic acid and magnesium ions. After precipitation, serum was centrifuged and HDL-c was estimated in the supernatant by enzymatic method using cholesterol esterase, cholesterol oxidase, peroxidase, 4-amino antipyrine and phenol.

Estimation of HDL-c was carried out in two steps. By the kit provided by 'Monozyme India Limited'.

(a) 1st step

In a centrifuge tube following substances were taken :

| | |
|---|---|
| Serum | 0.2ml |
| Precipitating reagent (2) | 0.3ml |

Contents were mixed well and were kept at room temperature for 5 minutes following which it was centrifuged at 3000rpm for 10 minutes to get a clear supernatant.

(b) 2nd step

Same procedure as for the total cholesterol estimation as described above was followed, only the test sample was changed.

| | Test (TH) | Standard (s) | Blank (b) |
|---|---|---|---|
| Enzyme reagent (1) | 1.0ml | 1.0ml | 1.0ml |
| Cholesterol standard (3) (200mg%) | | 0.01ml (10µl) | |
| Supernatant (from step1) | 0.1ml (10µl) | | |
| Distilled water | | 0.1ml | 0.1ml |

Similarly as for the total cholesterol the tubes were incubated and the optical density was measured.

Calculation was done as follows:

$$\text{HDL cholesterol (mg/dl)} = \frac{\text{O.D. of TH}}{\text{O.D. of S}} \times 50$$

(normal expected value >40mg/dl)

4. Low density lipoprotein cholesterol and very low density lipoprotein (LDL and VLDL). VLDL-c and LDL-c were calculated by the following formula given by Friedelwald et al (1972) and Fredrickson DS (1972) respectively.

VLDL-c (mg/dl) = STG/5 (this formula is valid if STG value is <600mg/dl)

LDL-c (mg/dl) = STC - (STG/5+HDL-c)

STC - (VLDL-c+HDL-c)

**Analysis :**

Results obtained were analysed statistically by student's t-test (Paired t-test).

Results were compared with each group and then conclusion was drawn.

**Values of STC, LDL, HDL and Triglyceride are considered as normal or abnormal according to Adult Treatment Panel-III (ATP-III)**

| **Total Cholesterol (mg/dl)** | |
|---|---|
| <200 | Desirable |
| 200-239 | Borderline high |
| >240 | High |
| **LDL Cholesterol (mg/dl)** | |
| <100 | Optimal |
| 100-129 | Near or above optimal |
| 130-159 | Borderline |
| 159-190 | High |
| >190 | Very high |
| **HDL cholesterol (mg/dl)** | |
| <40 | Low |
| >60 | High |
| **Triglyceride (mg/dl)** | |
| <150 | Normal |
| 150-199 | Borderline high |
| 200-499 | High |
| >500 | Very high |

# *Observation*

# OBSERVATION

The present study included 27 subjects which were divided into 3 groups. Each group comprised of 9 subjects.

Study comprised of subjects who were hypercholesterolemic (>200mg/dl) or were having high serum triglyceride levels (>200mg/dl) or both.

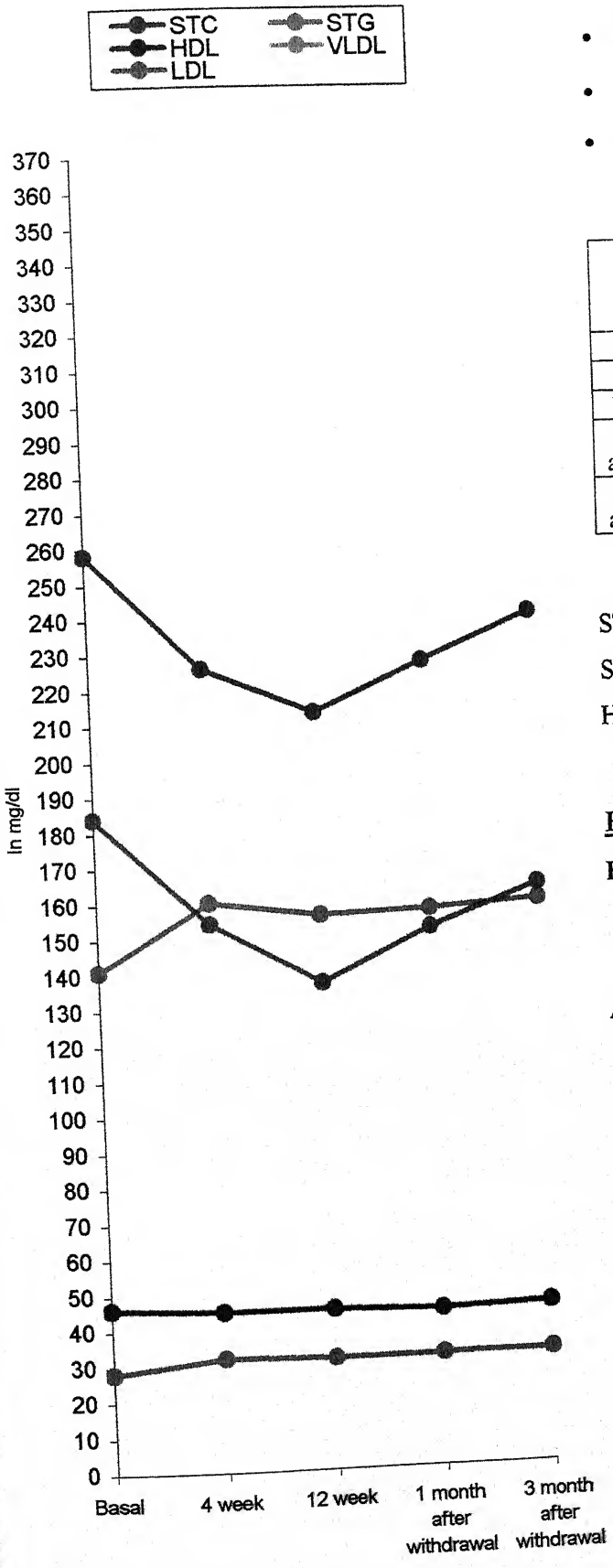
Subjects of group A were counselled to take one clove of raw garlic. Subjects of group B were counselled to take 4 garlic pearls and of group C were counselled to take simvastatin 20mg per day respectively. The care was taken not to consider the individuals who had taken drug other than specified to particular group with any effect on serum lipid lipoprotein profile.

All these were considered to note the response of raw garlic, garlic pearls and simvastatin on the lipid lipoprotein profile i.e. the levels of serum total cholesterol (STC), serum triglyceride (STG), serum high density lipoprotein (HDL), serum low density lipoprotein (LDL) and LDL/HDL ratio.

**Abbreviations used in the tables are :**

| | |
|---|---|
| **STC** | Serum total cholesterol |
| **STG** | Serum triglyceride |
| **HDL** | Serum high density lipoprotein |
| **VLDL** | Serum very low density lipoprotein |
| **LDL** | Serum low density lipoprotein |
| **LDL/HDL** | Ratio of low density lipoprotein to high density lipoprotein |
| **M/F** | Male/female |
| **MI** | Myocardial infarction |
| **With*** | Withdrawal |
| **AV Block** | Atrioventricular block |
| **NIDDM** | Non insulin dependent diabetes mellitus |
| **RBBB** | Right Bundle branch block |
| **TB** | Tuberculosis |
| **CAD** | coronary artery disease |

# RAW GARLIC GROUP




- **Puttan, 40 years/M**
- **Anterior wall MI with sinus arrest**
- **Hypercholesterolemia**

| | In mg/dl | | | | | |
|---|---|---|---|---|---|---|
| | STC | STG | HDL | VLDL | LDL | LDL/ HDL |
| Basal | 258 | 141 | 46 | 28 | 184 | 4.0:1 |
| 4 week | 226 | 160 | 45 | 32 | 154 | 3.4:1 |
| 12 week | 213 | 156 | 45 | 31.2 | 136.8 | 3.0:1 |
| 1 month after with* | 227 | 157 | 44 | 31.4 | 151.6 | 3.4:1 |
| 3 month after with* | 240 | 159 | 45 | 31.8 | 163.2 | 3.6:1 |

STC 1 mmol/L = 38.76 mg/dl

STG mmol/L = mg/dl × 0.0114

HDL mmol/L = mg/dl / 38.76

**Fasting values :**

**Basal –**

High STC, Normal STG,
Normal HDL and High LDL

**After 4 weeks of treatment –**

12.4% ↓(STC), 13.5% ↑(STG),
2.1% ↓(HDL), 16.3% ↓(LDL)

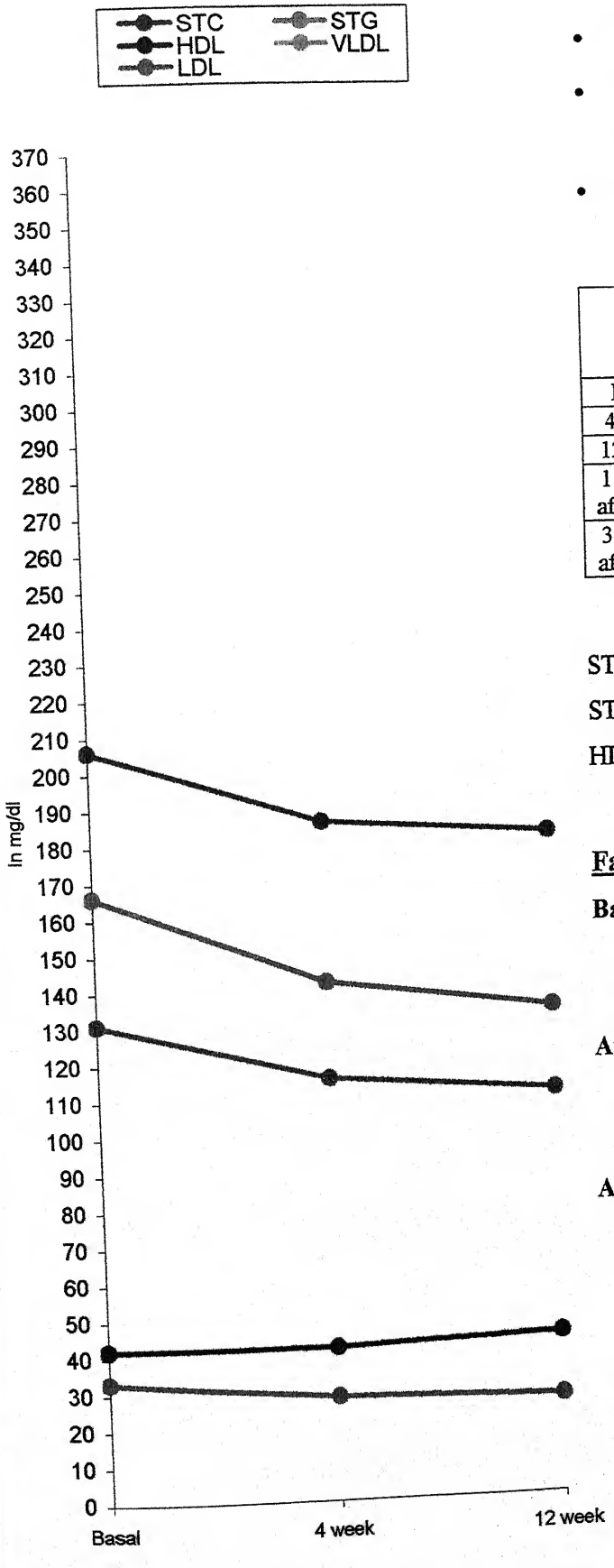
**After 12 weeks of treatment –**

17.4% ↓ (STC), 10.6% ↑(STG),
2.1% ↓ (HDL), 25.6% ↓ (LDL)

**After 3 months of withdrawal –**

7.5% ↓ (STC), 12.7% ↑(STG),
2.1% ↓ (HDL), 11.3% ↓ (LDL)

# RAW GARLIC GROUP




- **Premdubey, 46 years/F**
- **Systemic hypertension with 1st degree AV block**
- **Hypercholesterolemia**

| | In mg/dl | | | | | |
|---|---|---|---|---|---|---|
| | STC | STG | HDL | VLDL | LDL | LDL/ HDL |
| Basal | 206 | 166 | 42 | 33 | 131 | 3.1:1 |
| 4 week | 186 | 142 | 42 | 28.4 | 115.6 | 2.8:1 |
| 12 week | 182 | 134 | 44 | 26.8 | 111.2 | 2.5:1 |
| 1 month after with* | - | - | - | - | - | - |
| 3 month after with* | - | - | - | - | - | - |

STC 1 mmol/L = 38.76 mg/dl

STG mmol/L = mg/dl × 0.0114

HDL mmol/L = mg/dl / 38.76

**Fasting values :**

**Basal –**

High STC, Normal STG,

Normal HDL and High LDL

**After 4 weeks of treatment –**

9.7% ↓(STC), 14.45% ↓(STG),

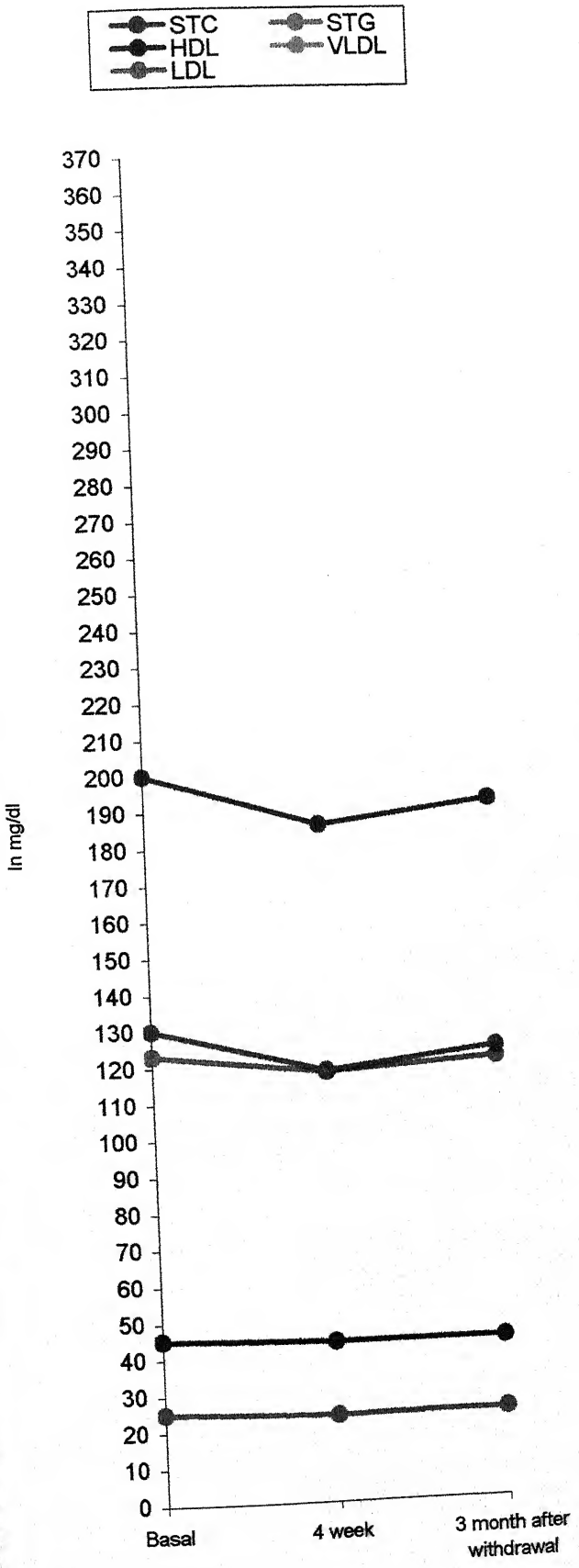
No change in HDL, 11.7% ↓(LDL)

**After 12 weeks of treatment –**

11.6% ↓ (STC), 19.3% ↓(STG),

4.8% ↑ (HDL), 15.1% ↓ (LDL)

# RAW GARLIC GROUP




- **Ragvendra Sharma, 68 years/M**
- **Acute Anterior wall MI**
- **Hypercholesterolemia**

| | In mg/dl | | | | | |
|---|---|---|---|---|---|---|
| | STC | STG | HDL | VLDL | LDL | LDL/ HDL |
| Basal | 200 | 123 | 45 | 25 | 130 | 2.9:1 |
| 4 week | 186 | 118 | 44 | 23.6 | 118.4 | 2.7:1 |
| 12 week | - | - | - | - | - | - |
| 1 month after with* | - | - | - | - | - | - |
| 3 month after with* | 192 | 121 | 44 | 24.2 | 123.8 | 2.86:1 |

STC 1 mmol/L = 38.76 mg/dl

STG mmol/L = mg/dl × 0.0114

HDL mmol/L = mg/dl / 38.76

**Fasting values :**

**Basal –**

High STC, Normal STG,

Normal HDL and High LDL

**After 4 weeks of treatment –**

7% ↓(STC), 4.06% ↓(STG),

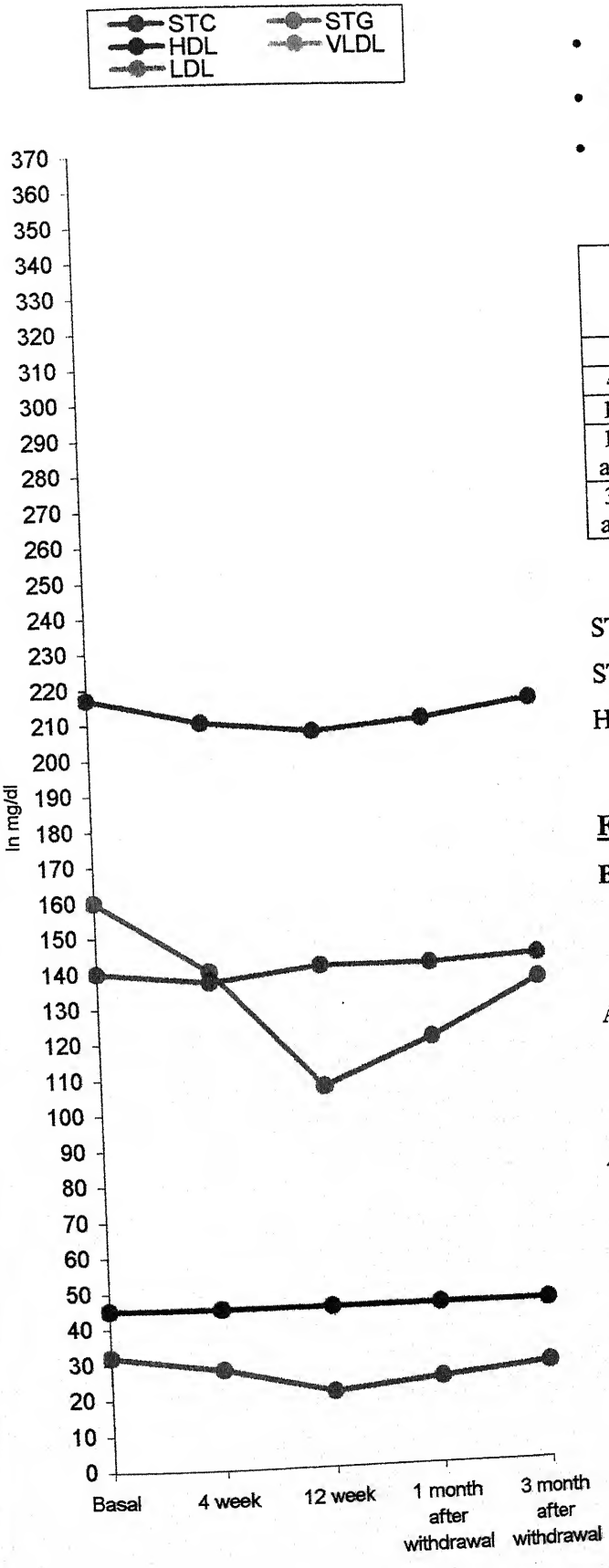
2.2% ↓(HDL), 8.9% ↓(LDL)

**After 3 months of withdrawal –**

4% ↓ (STC), 1.6% ↓(STG),

2.2% ↓ (HDL), 4.8% ↓ (LDL)

# RAW GARLIC GROUP




- **Madan Mohan Soni, 41 years/M**
- **Diabetes Mellitus**
- **Hypercholesterolemia**

| | In mg/dl | | | | | |
|---|---|---|---|---|---|---|
| | STC | STG | HDL | VLDL | LDL | LDL/ HDL |
| Basal | 217 | 160 | 45 | 32 | 140 | 3.1:1 |
| 4 week | 210 | 140 | 45 | 28 | 137 | 3.0:1 |
| 12 week | 207 | 107 | 45 | 21 | 141 | 3.1:1 |
| 1 month after with* | 210 | 120 | 45 | 24 | 141 | 3.1:1 |
| 3 month after with* | 215 | 136 | 45 | 27.2 | 142.8 | 3.1:1 |

STC 1 mmol/L = 38.76 mg/dl

STG mmol/L = mg/dl × 0.0114

HDL mmol/L = mg/dl / 38.76

**Fasting values :**

**Basal –**

High STC, Normal STG,

Normal HDL and High LDL

**After 4 weeks of treatment –**

3.2% ↓(STC), 12.5% ↓(STG),

No change in HDL, 2.1% ↓(LDL)

**After 12 weeks of treatment –**

4.6% ↓ (STC), 33.12% ↓(STG),

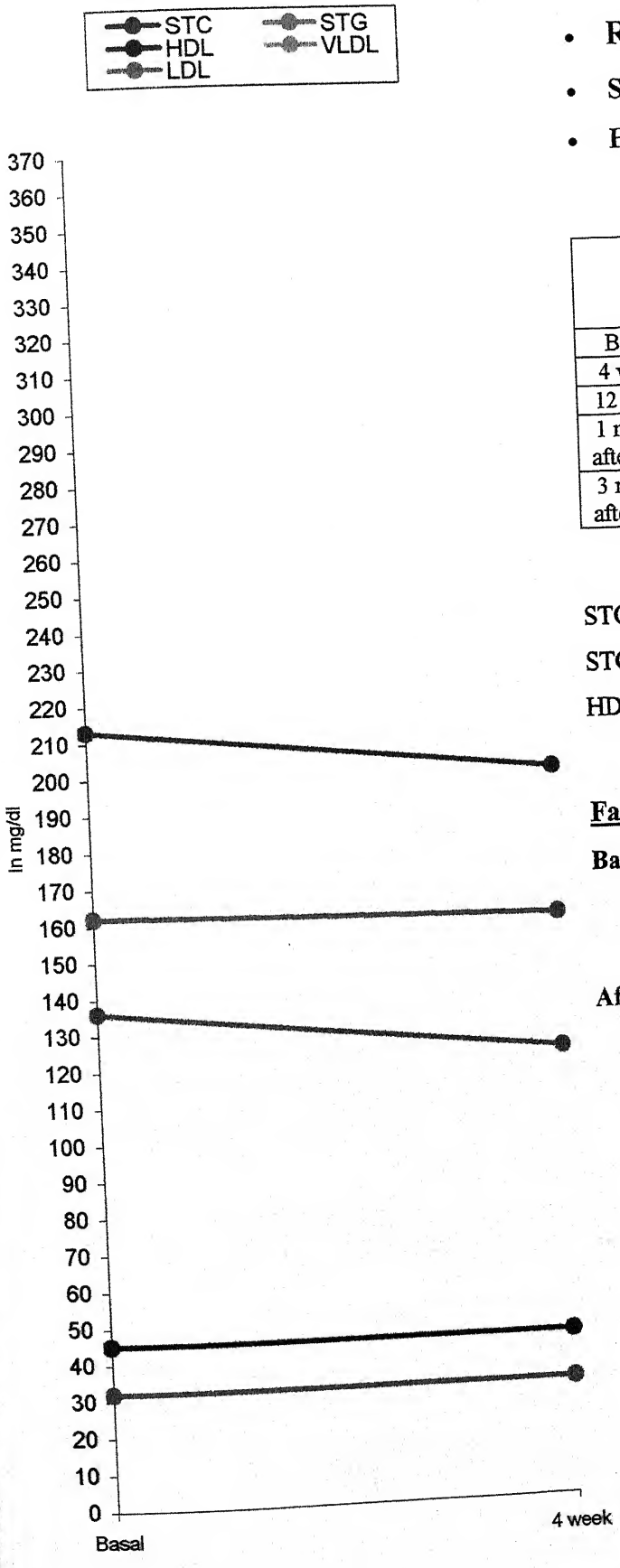
No change in HDL, 0.7% ↑ (LDL)

**After 3 months of withdrawal –**

0.92% ↓ (STC), 15% ↓(STG),

No change in HDL, 2% ↑ (LDL)

# RAW GARLIC GROUP




- **Raja Bai, 52 years/F**
- **Systemic hypertension**
- **Hypercholesterolemia**

| | In mg/dl | | | | | |
|---|---|---|---|---|---|---|
| | STC | STG | HDL | VLDL | LDL | LDL/ HDL |
| Basal | 213 | 162 | 45 | 32 | 136 | 3:1 |
| 4 week | 200 | 160 | 45 | 32 | 123 | 2.7:1 |
| 12 week | - | - | - | - | - | - |
| 1 month after with* | - | - | - | - | - | - |
| 3 month after with* | - | - | - | - | - | - |

STC 1 mmol/L = 38.76 mg/dl

STG mmol/L = mg/dl × 0.0114

HDL mmol/L = mg/dl / 38.76

**Fasting values :**

**Basal –**

High STC, Normal STG,

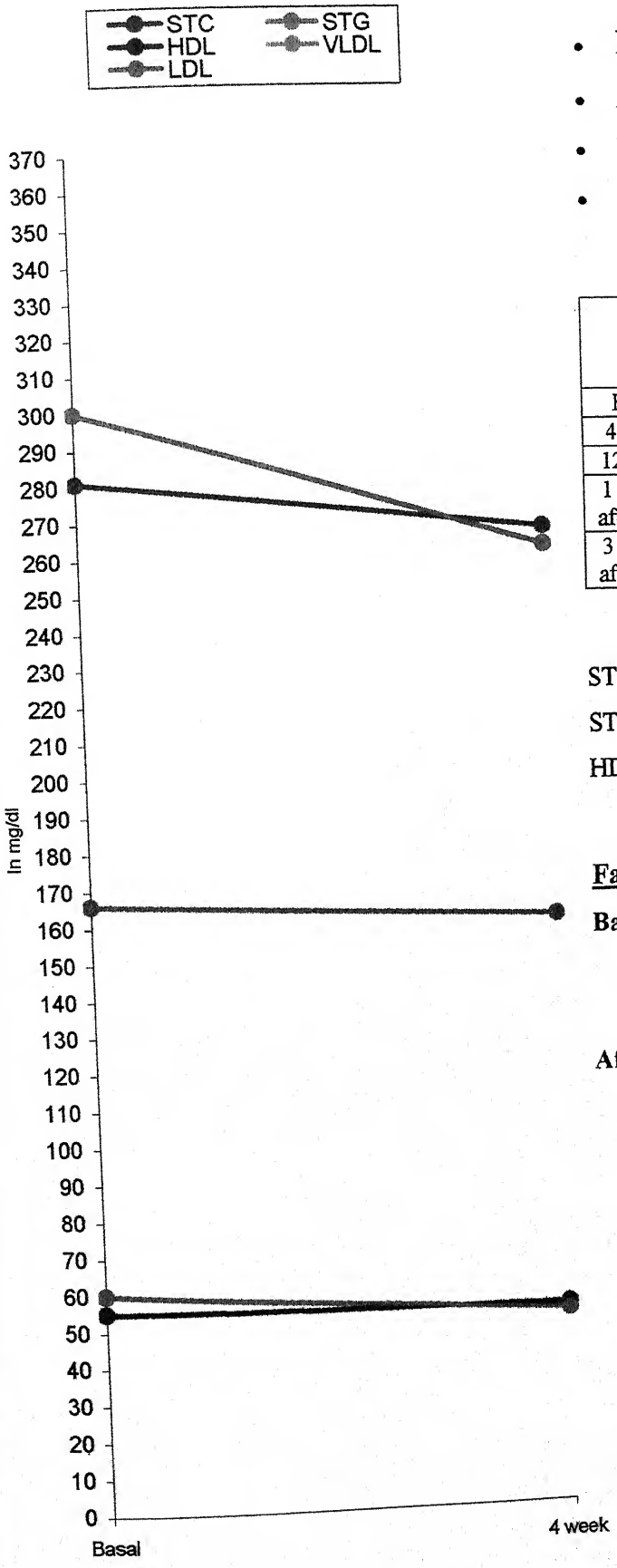
Normal HDL and High LDL

**After 4 weeks of treatment –**

6.1% ↓(STC), 1.23% ↓(STG),

No change in HDL, 9.5% ↓(LDL)

# RAW GARLIC GROUP




- **Ramrati, 40 years/F**
- **Adult Nephrotic syndrome**
- **Hypercholesterolemia**
- **Hypertriglyceridemia**

| | In mg/dl | | | | | |
|---|---|---|---|---|---|---|
| | STC | STG | HDL | VLDL | LDL | LDL/ HDL |
| Basal | 281 | 300 | 55 | 60 | 166 | 3.0:1 |
| 4 week | 267 | 262 | 54 | 52.4 | 160.6 | 3.0:1 |
| 12 week | - | - | - | - | - | - |
| 1 month after with* | - | - | - | - | - | - |
| 3 month after with* | - | - | - | - | - | - |

STC 1 mmol/L = 38.76 mg/dl

STG mmol/L = mg/dl × 0.0114

HDL mmol/L = mg/dl / 38.76

**Fasting values :**

**Basal –**

High STC, High STG,

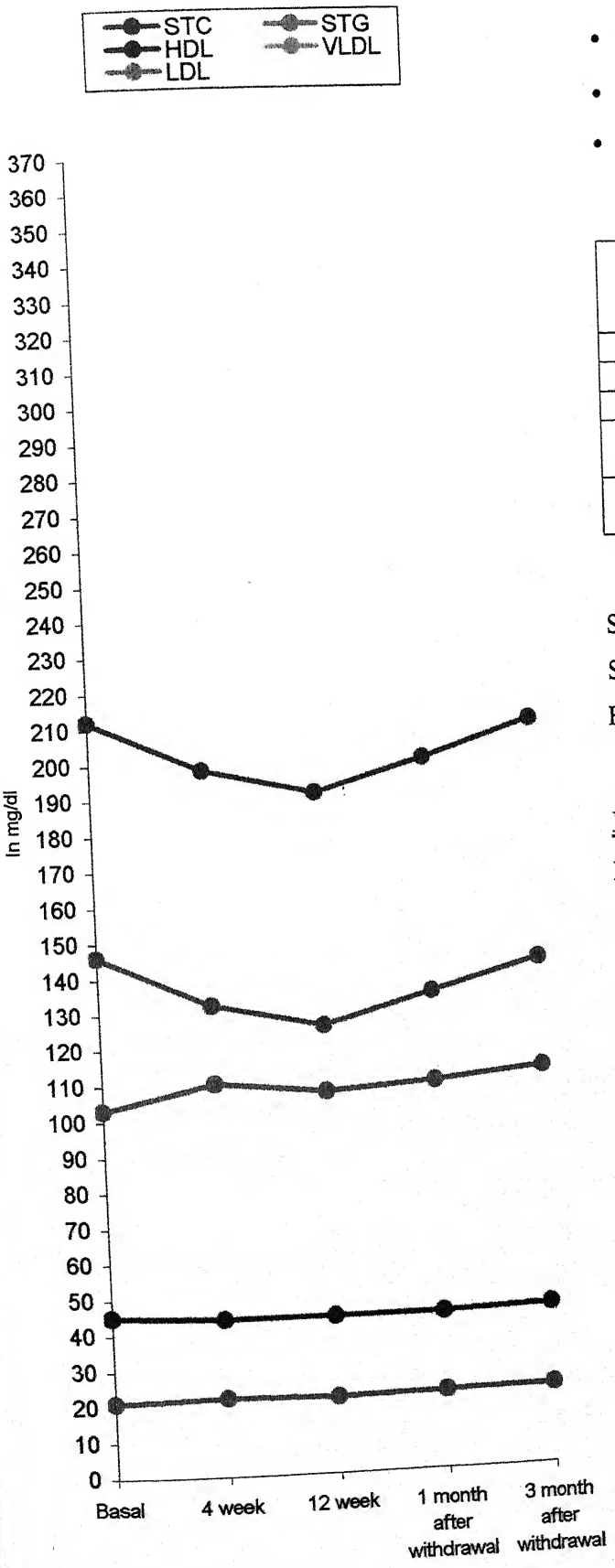
Normal HDL and High LDL

**After 4 weeks of treatment –**

5.0% ↓(STC), 12.66% ↓(STG),

1.81% ↓(HDL), 3.25% ↓(LDL)

# RAW GARLIC GROUP




- **Lila Devi, 60 years/F**
- **Systemic hypertension**
- **Hypercholesterolemia**

| | In mg/dl | | | | | |
|---|---|---|---|---|---|---|
| | STC | STG | HDL | VLDL | LDL | LDL/ HDL |
| Basal | 212 | 103 | 45 | 21 | 146 | 3.2:1 |
| 4 week | 198 | 110 | 44 | 22 | 132 | 3:1 |
| 12 week | 191 | 107 | 44 | 21.4 | 125.6 | 2.9:1 |
| 1 month after with | 200 | 109 | 44 | 21.8 | 134.2 | 3.0:1 |
| 3 month after with | 210 | 112 | 45 | 22.4 | 142.6 | 3.2:1 |

STC 1 mmol/L = 38.76 mg/dl

STG mmol/L = mg/dl × 0.0114

HDL mmol/L = mg/dl / 38.76

**Fasting values :**

**Basal –**

High STC, Normal STG,

Normal HDL and High LDL

**After 4 weeks of treatment –**

6.6% ↓(STC), 6.8% ↑(STG),

2.2% ↓(HDL), 9.5% ↓(LDL)

**After 12 weeks of treatment –**

9.9% ↓ (STC), 3.8% ↑(STG),

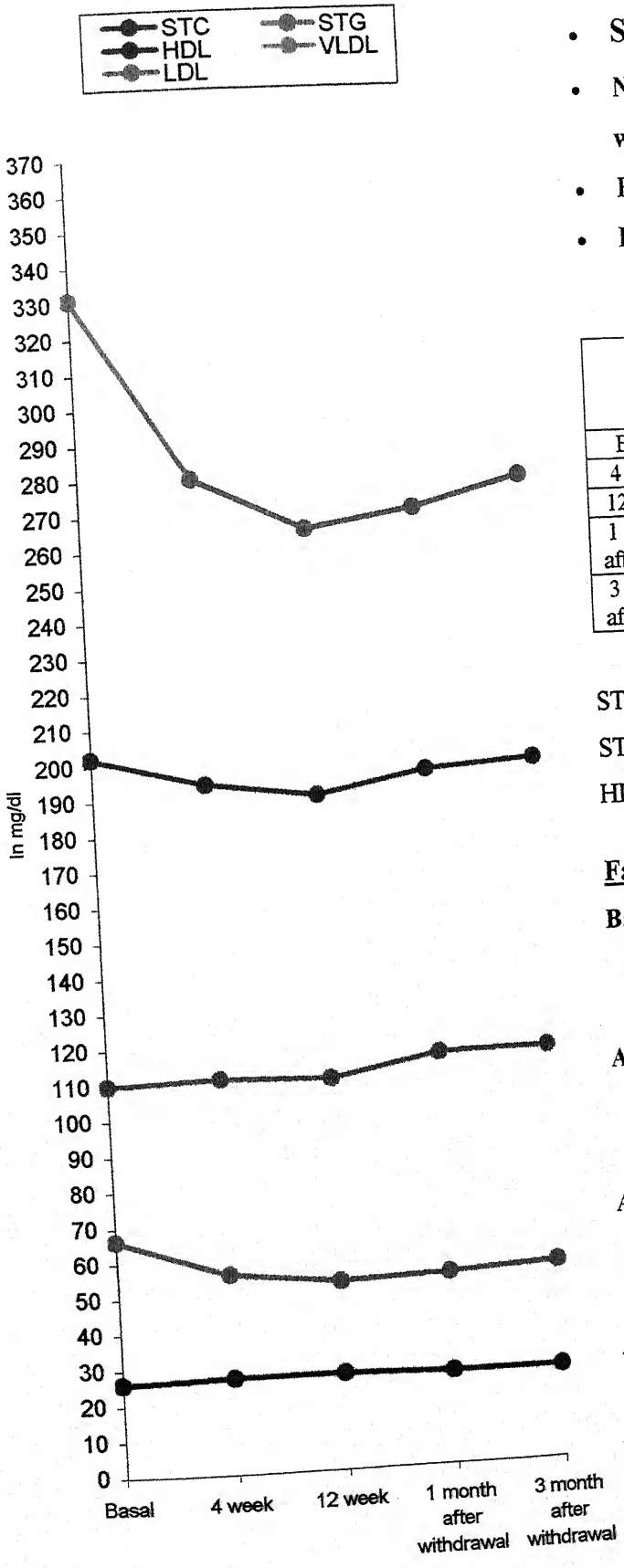
2.2% ↓ (HDL), 13.9% ↓ (LDL)

**After 3 months of withdrawal –**

0.94% ↓ (STC), 8.7% ↑(STG),

No Change in HDL, 2.3% ↓ (LDL)

# RAW GARLIC GROUP




- **Shanti Devi, 65 years/F**
- **NIDDM with diabetic nephropathy with dyslipidemia**
- **Hypercholesterolemia**
- **Hypertriglyceridemia**

| | In mg/dl | | | | | |
|---|---|---|---|---|---|---|
| | STC | STG | HDL | VLDL | LDL | LDL/ HDL |
| Basal | 202 | 331 | 26 | 66.2 | 109.8 | 4.2:1 |
| 4 week | 194 | 280 | 27 | 56 | 111 | 4.1:1 |
| 12 week | 190 | 265 | 27 | 53 | 110 | 4.1:1 |
| 1 month after with* | 196 | 270 | 26 | 54 | 116 | 4.4:1 |
| 3 month after with* | 198 | 278 | 26 | 55.6 | 116.4 | 4.5:1 |

STC 1 mmol/L = 38.76 mg/dl

STG mmol/L = mg/dl × 0.0114

HDL mmol/L = mg/dl / 38.76

**Fasting values :**

**Basal –**

High STC, High STG,
Low HDL and High LDL

**After 4 weeks of treatment –**

3.96% ↓(STC), 15.4% ↓(STG),
3.8% ↑(HDL), 1.09% ↑(LDL)

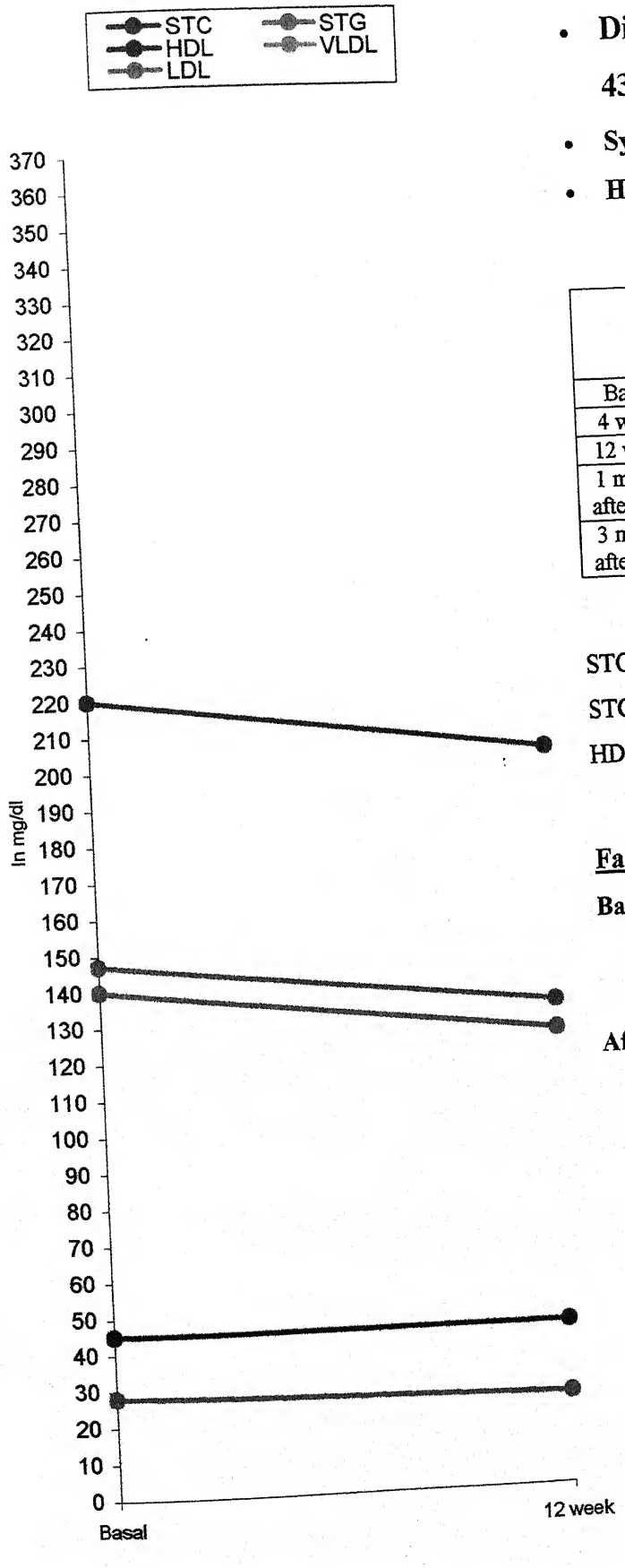
**After 12 weeks of treatment –**

5.9% ↓ (STC), 19.9% ↓(STG),
3.8% ↑ (HDL), 0.19% ↑ (LDL)

**After 3 months of withdrawal –**

1.9% ↓ (STC), 16.0% ↓(STG),
No change in HDL, 6.0% ↑ (LDL)

# RAW GARLIC GROUP




- **Dinesh Kumar Gupta,**

  **43 years/M**
- **Systemic hypertension**
- **Hypercholesterolemia**

| | In mg/dl | | | | | |
|---|---|---|---|---|---|---|
| | STC | STG | HDL | VLDL | LDL | LDL/ HDL |
| Basal | 220 | 140 | 45 | 28 | 147 | 3.3:1 |
| 4 week | - | - | - | - | - | - |
| 12 week | 204 | 126 | 45 | 25.2 | 133.8 | 3.0:1 |
| 1 month after with* | - | - | - | - | - | - |
| 3 month after with* | - | - | - | - | - | - |

STC 1 mmol/L = 38.76 mg/dl

STG mmol/L = mg/dl × 0.0114

HDL mmol/L = mg/dl / 38.76

**Fasting values :**

**Basal –**

High STC, Normal STG,

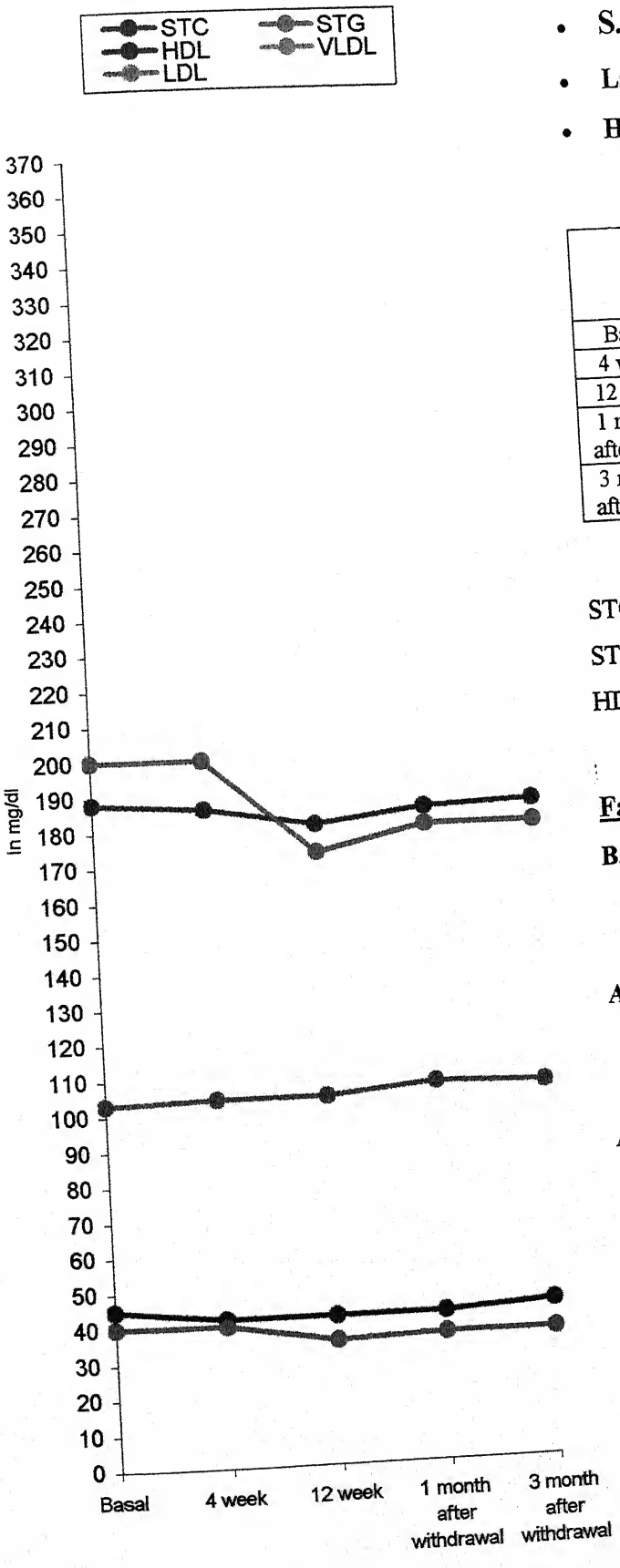
Normal HDL and High LDL

**After 12 weeks of treatment –**

7.2% ↓ (STC), 10% ↓(STG),

No change in HDL, 8.9% ↓ (LDL)

# GARLIC PEARLS GROUP




- **S.A. Kadri, 42 years/M**
- **Lateral wall ischemia**
- **Hypertriglyceridemia**

| | In mg/dl | | | | | |
|---|---|---|---|---|---|---|
| | STC | STG | HDL | VLDL | LDL | LDL/ HDL |
| Basal | 188 | 200 | 45 | 40 | 103 | 2.2:1 |
| 4 week | 186 | 200 | 42 | 40 | 104 | 2.4:1 |
| 12 week | 181 | 173 | 42 | 35 | 104 | 2.4:1 |
| 1 month after with | 185 | 180 | 42 | 36 | 107 | 2.5:1 |
| 3 month after with | 186 | 180 | 44 | 36 | 106 | 2.4:1 |

STC 1 mmol/L = 38.76 mg/dl

STG mmol/L = mg/dl × 0.0114

HDL mmol/L = mg/dl / 38.76

**Fasting values :**

**Basal –**

Normal STC, High STG,

Normal HDL and High LDL

**After 4 weeks of treatment –**

1.07% ↓(STC), No change in STG,

6.6% ↓(HDL), 0.97% ↑(LDL)

**After 12 weeks of treatment –**

3.72% ↓ (STC), 13.5% ↓(STG),

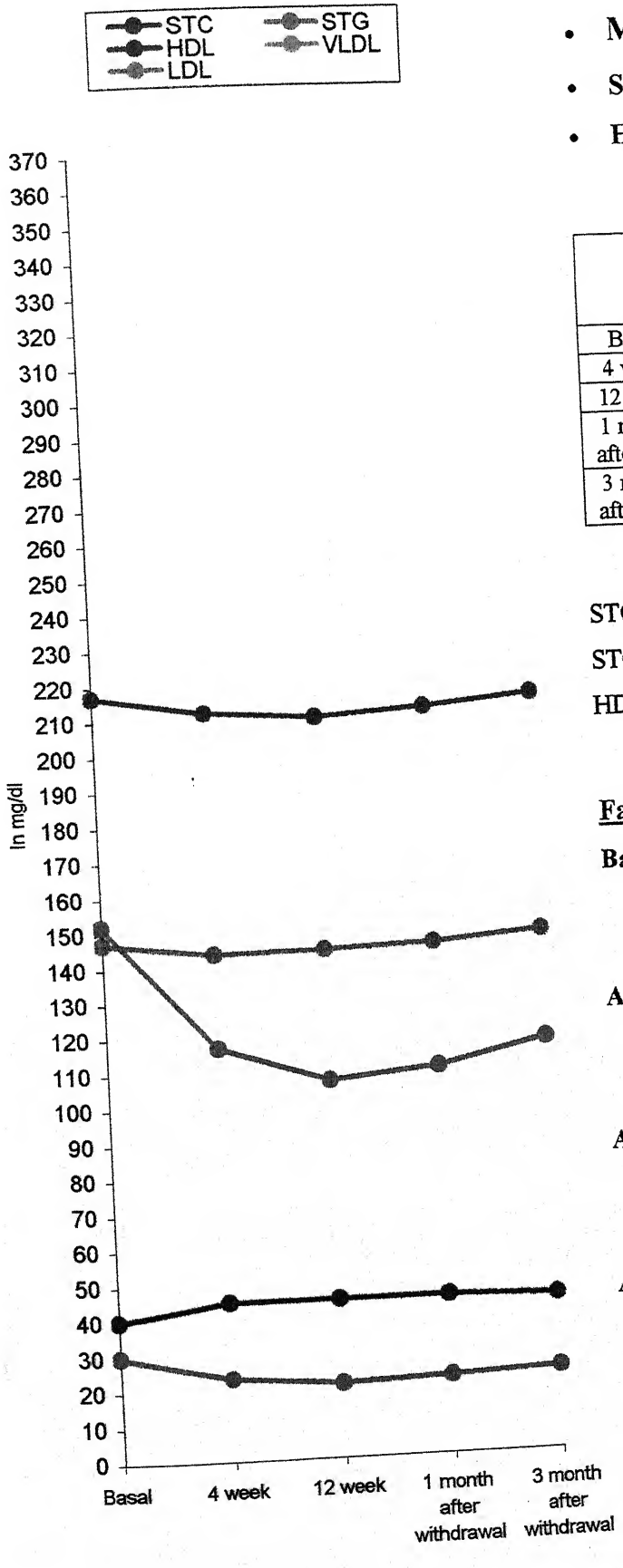
6.6% ↓ (HDL), 0.97% ↑ (LDL)

**After 3 months of withdrawal –**

1.06% ↓ (STC), 10% ↓(STG),

2.2% ↓ (HDL), 2.91% ↑ (LDL)

# GARLIC PEARLS GROUP




- **M. Barua, 45 years/F**
- **Systemic hypertension**
- **Hypercholesterolemia**

| | In mg/dl | | | | | |
|---|---|---|---|---|---|---|
| | STC | STG | HDL | VLDL | LDL | LDL/ HDL |
| Basal | 217 | 152 | 40 | 30 | 147 | 3.6:1 |
| 4 week | 212 | 117 | 45 | 23.4 | 143.6 | 3.1:1 |
| 12 week | 210 | 107 | 45 | 21 | 144 | 3.1:1 |
| 1 month after with* | 212 | 110 | 45 | 22 | 145 | 3.2:1 |
| 3 month after with* | 215 | 117 | 44 | 23.4 | 147.6 | 3.3:1 |

STC 1 mmol/L = 38.76 mg/dl

STG mmol/L = mg/dl × 0.0114

HDL mmol/L = mg/dl / 38.76

**Fasting values :**

**Basal –**

High STC, Normal STG,
Normal HDL and High LDL

**After 4 weeks of treatment –**

2.3% ↓(STC), 23% ↓(STG),
12.5% ↑(HDL), 2.3% ↓(LDL)

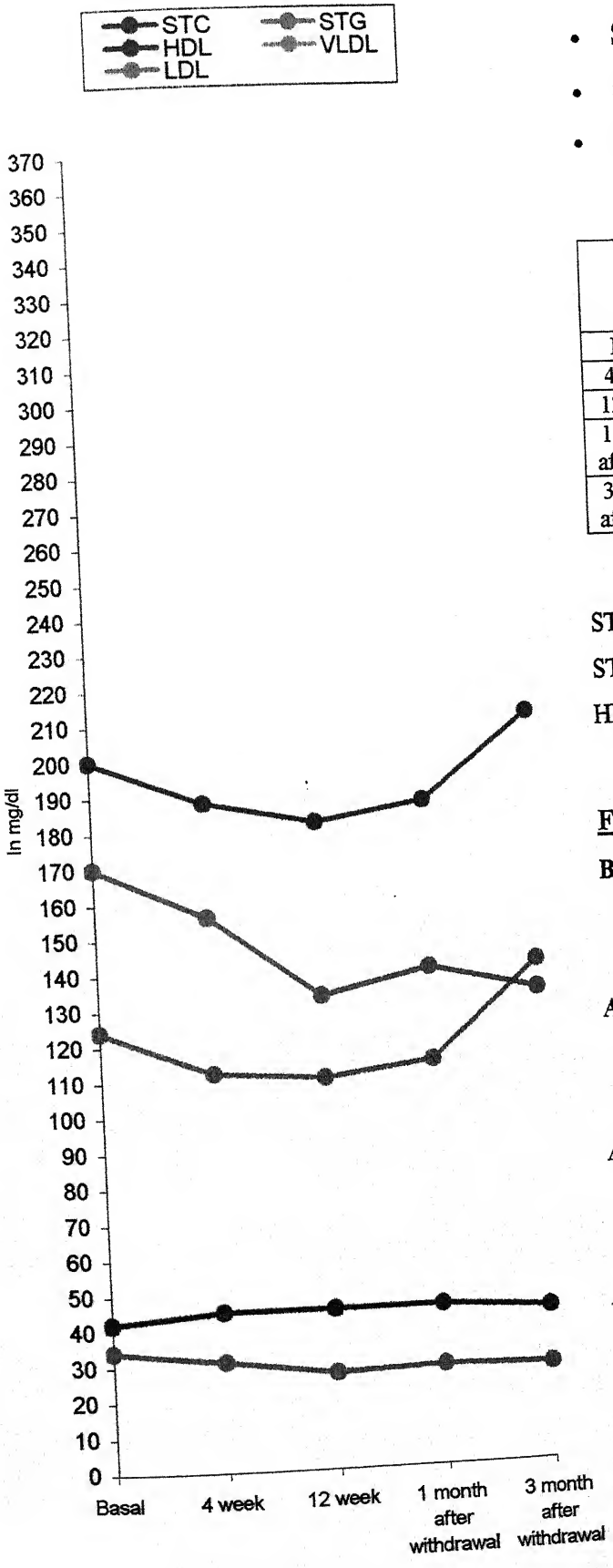
**After 12 weeks of treatment –**

3.2% ↓ (STC), 29.6% ↓(STG),
12.5% ↑ (HDL), 2.0% ↑ (LDL)

**After 3 months of withdrawal –**

0.92% ↓ (STC), 23% ↓(STG),
10% ↑ (HDL), 0.4% ↑ (LDL)

# GARLIC PEARLS GROUP




- **Sunil Kumar, 35 years/M**
- **Systemic hypertension**
- **Hypercholesterolemia**

| | In mg/dl | | | | | |
|---|---|---|---|---|---|---|
| | STC | STG | HDL | VLDL | LDL | LDL/ HDL |
| Basal | 200 | 170 | 42 | 34 | 124 | 2.9:1 |
| 4 week | 188 | 156 | 45 | 31 | 112 | 2.5:1 |
| 12 week | 182 | 133 | 45 | 27 | 110 | 2.4:1 |
| 1 month after with* | 187 | 140 | 45 | 28 | 114 | 2.5:1 |
| 3 month after with* | 211 | 133 | 43 | 27 | 141 | 3.2:1 |

STC 1 mmol/L = 38.76 mg/dl

STG mmol/L = mg/dl × 0.0114

HDL mmol/L = mg/dl / 38.76

**Fasting values :**

**Basal –**

High STC, Normal STG,
Normal HDL and High LDL

**After 4 weeks of treatment –**

6% ↓(STC), 8.2% ↓(STG),
7.1% ↑(HDL), 9.6% ↓(LDL)

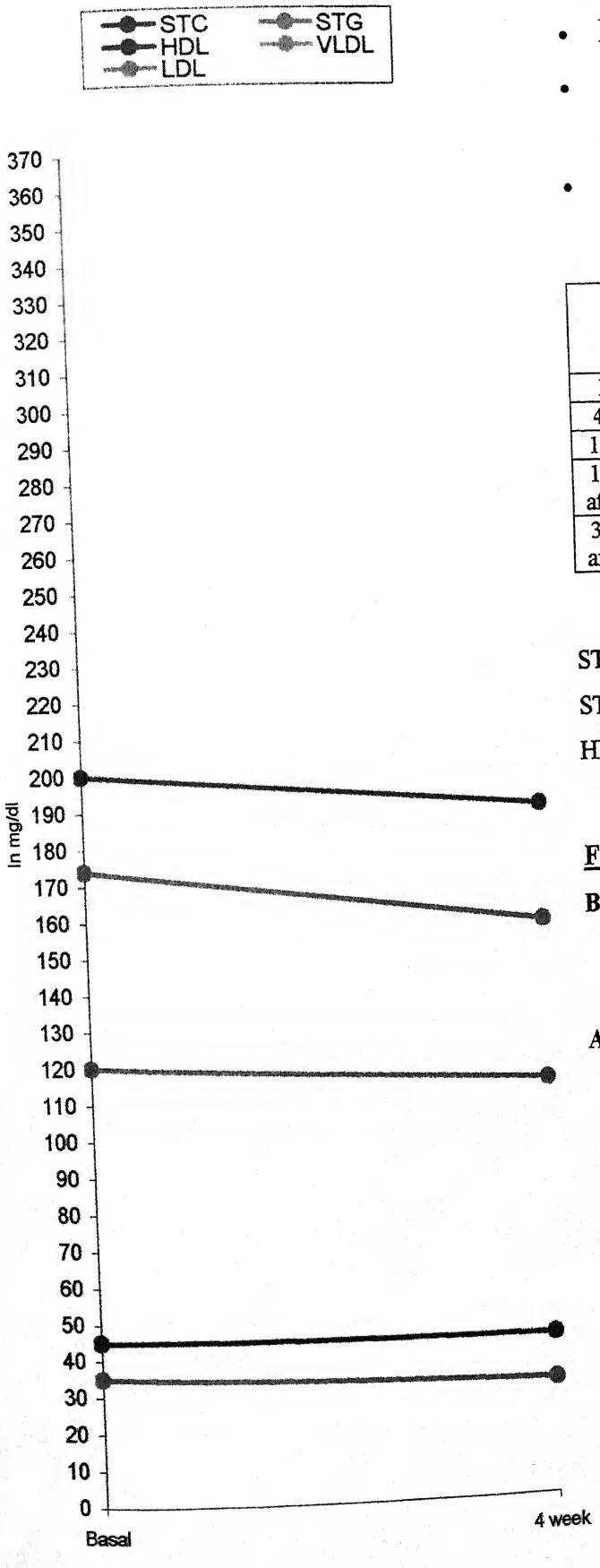
**After 12 weeks of treatment –**

9% ↓ (STC), 21.7% ↓(STG),
7.1% ↑ (HDL), 11.2% ↓ (LDL)

**After 3 months of withdrawal –**

5.5% ↑ (STC), 21.7% ↓(STG),
2.3% ↑ (HDL), 13.7% ↑ (LDL)

# GARLIC PEARLS GROUP




- **Hanuman Prasad, 66 years/M**
- **Cellulitis with post infectious glomerulonephritis**
- **Hypercholesterolemia**

| | In mg/dl | | | | | |
|---|---|---|---|---|---|---|
| | STC | STG | HDL | VLDL | LDL | LDL/ HDL |
| Basal | 200 | 174 | 45 | 35 | 120 | 2.7:1 |
| 4 week | 190 | 158 | 44 | 31.6 | 114.4 | 2.6:1 |
| 12 week | - | - | - | - | - | - |
| 1 month after with* | - | - | - | - | - | - |
| 3 month after with* | - | - | - | - | - | - |

STC 1 mmol/L = 38.76 mg/dl

STG mmol/L = mg/dl × 0.0114

HDL mmol/L = mg/dl / 38.76

**Fasting values :**

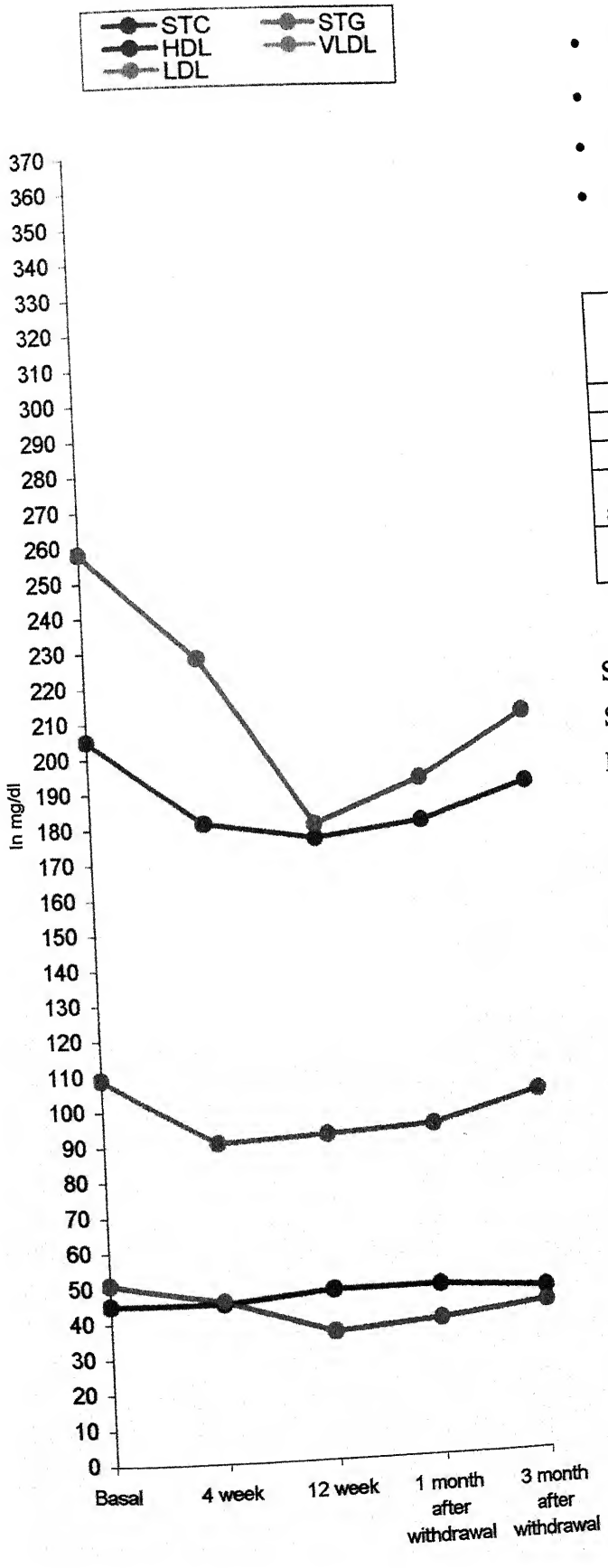
**Basal –**

High STC, Normal STG,
Normal HDL and High LDL

**After 4 weeks of treatment –**

5% ↓(STC), 9.19% ↓(STG),
2.2% ↓(HDL), 4.6% ↓(LDL)

# GARLIC PEARLS GROUP




- **Ashok Srivastava, 39 years/M**
- **Systemic hypertension**
- **Hypercholesterolemia**
- **Hypertriglyceridemia**

| | In mg/dl | | | | | |
|---|---|---|---|---|---|---|
| | STC | STG | HDL | VLDL | LDL | LDL/ HDL |
| Basal | 205 | 258 | 45 | 51.0 | 109 | 2.5:1 |
| 4 week | 181 | 228 | 45 | 45.6 | 90.4 | 2:1 |
| 12 week | 176 | 180 | 48 | 36.0 | 92.0 | 1.9:1 |
| 1 month after with* | 180 | 192 | 48 | 38.4 | 93.6 | 1.9:1 |
| 3 month after with* | 190 | 210 | 46 | 42.0 | 102 | 2.2:1 |

STC 1 mmol/L = 38.76 mg/dl

STG mmol/L = mg/dl × 0.0114

HDL mmol/L = mg/dl / 38.76

**Fasting values :**

**Basal –**

High STC, High STG,

Normal HDL and High LDL

**After 4 weeks of treatment –**

11.7% ↓(STC), 11.6% ↓(STG),

No change in HDL, 17.06% ↓(LDL)

**After 12 weeks of treatment –**

14.1% ↓ (STC), 30% ↓(STG),

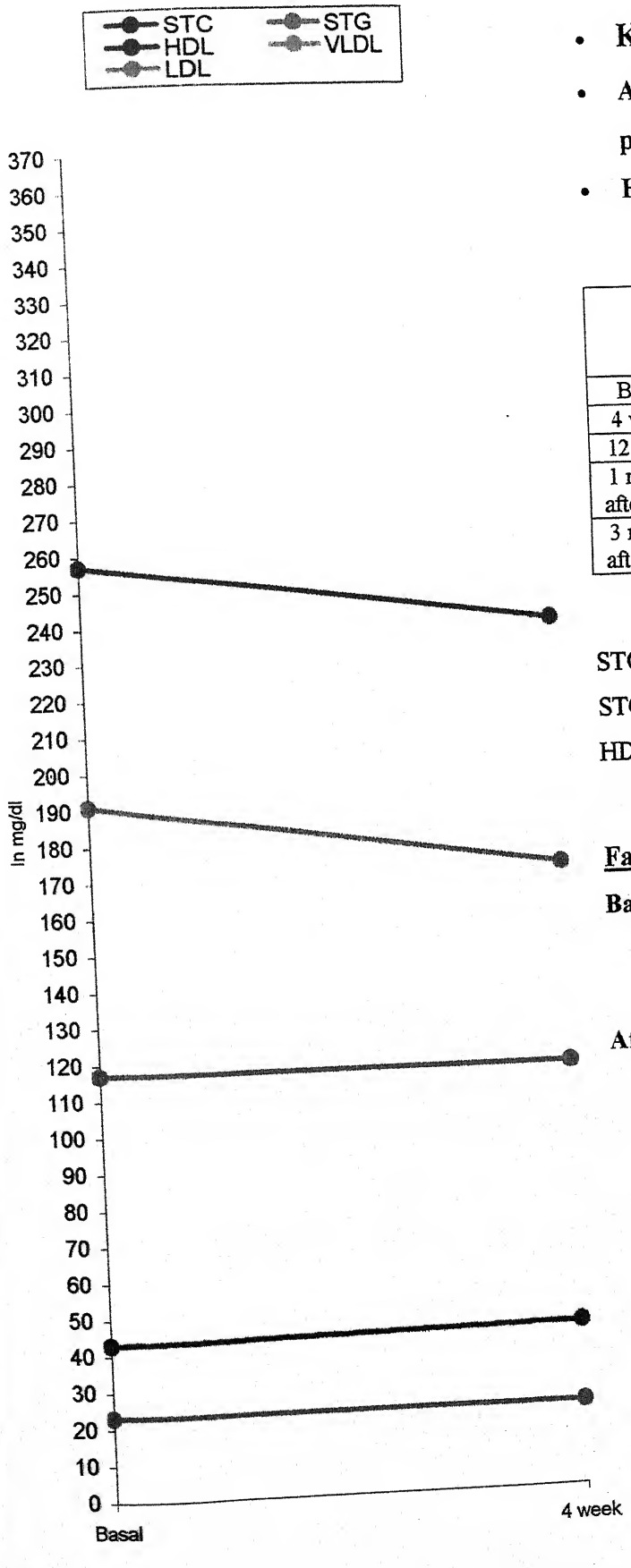
6.6% ↑ (HDL), 15.5% ↓ (LDL)

**After 3 months of withdrawal –**

7.3% ↓ (STC), 18.6% ↓(STG),

2.1% ↑ (HDL), 6.4% ↓ (LDL)

# GARLIC PEARLS GROUP




- **Kamta Prasad, 50 years/M**
- **Adult nephrotic syndrome with pulmonary TB**
- **Hypercholesterolemia**

| | In mg/dl | | | | | |
|---|---|---|---|---|---|---|
| | STC | STG | HDL | VLDL | LDL | LDL/ HDL |
| Basal | 257 | 117 | 43 | 23 | 191 | 4.4:1 |
| 4 week | 240 | 117 | 45 | 23 | 172 | 3.8:1 |
| 12 week | - | - | - | - | - | - |
| 1 month after with* | - | - | - | - | - | - |
| 3 month after with* | - | - | - | - | - | - |

STC 1 mmol/L = 38.76 mg/dl

STG mmol/L = mg/dl × 0.0114

HDL mmol/L = mg/dl / 38.76

**Fasting values :**

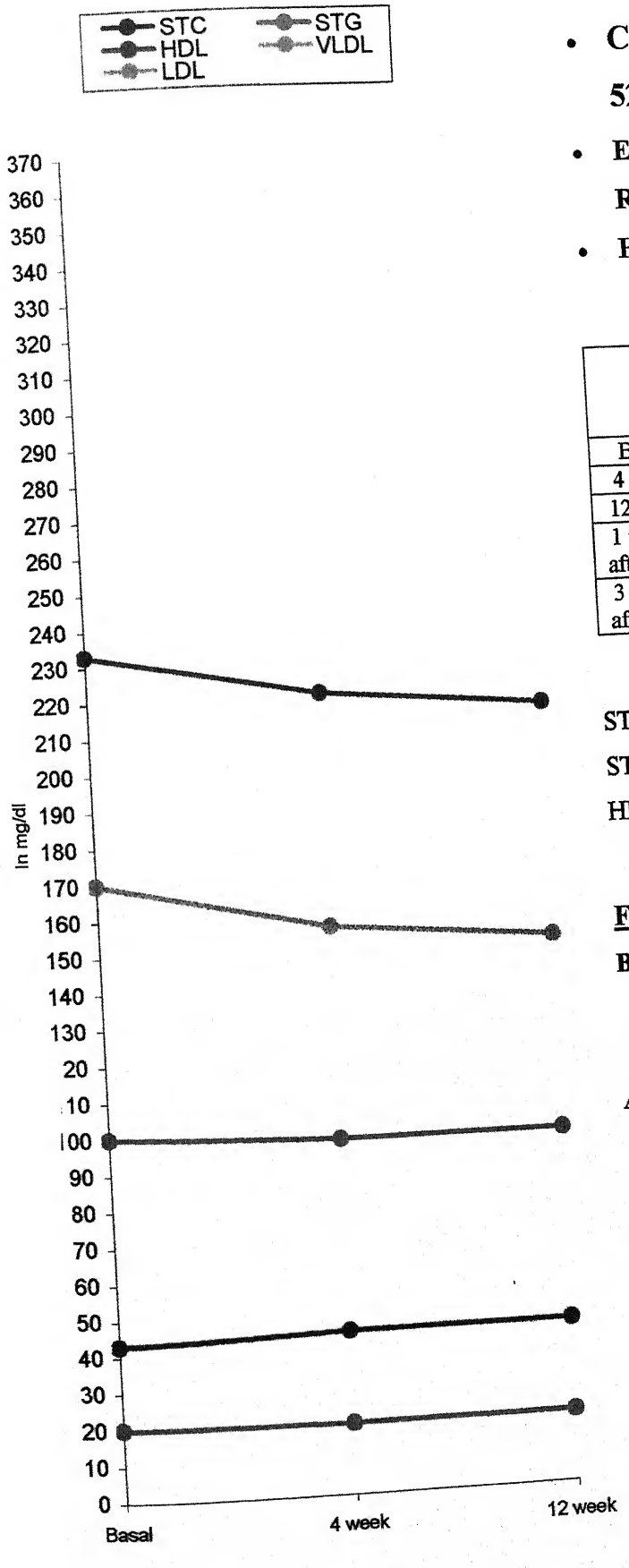
**Basal –**

High STC, Normal STG,
Normal HDL and High LDL

**After 4 weeks of treatment –**

6.6% ↓(STC), No change in STG,
4.6% ↑(HDL), 9.9% ↓(LDL)

# GARLIC PEARLS GROUP




- **Chandrashekar Diwedi,**
  **52 years/M**
- **Extensive anterior wall MI with R.B.B.B.**
- **Hypercholesterolemia**

| | In mg/dl | | | | | |
|---|---|---|---|---|---|---|
| | STC | STG | HDL | VLDL | LDL | LDL/ HDL |
| Basal | 233 | 100 | 43 | 20 | 170 | 3.9:1 |
| 4 week | 221 | 98 | 45 | 19.6 | 156.4 | 3.5:1 |
| 12 week | 216 | 98 | 45 | 19.6 | 151.4 | 3.4:1 |
| 1 month after with* | - | - | - | - | - | - |
| 3 month after with* | - | - | - | - | - | - |

STC 1 mmol/L = 38.76 mg/dl

STG mmol/L = mg/dl × 0.0114

HDL mmol/L = mg/dl / 38.76

**Fasting values :**

**Basal –**

High STC, Normal STG,
Normal HDL and High LDL

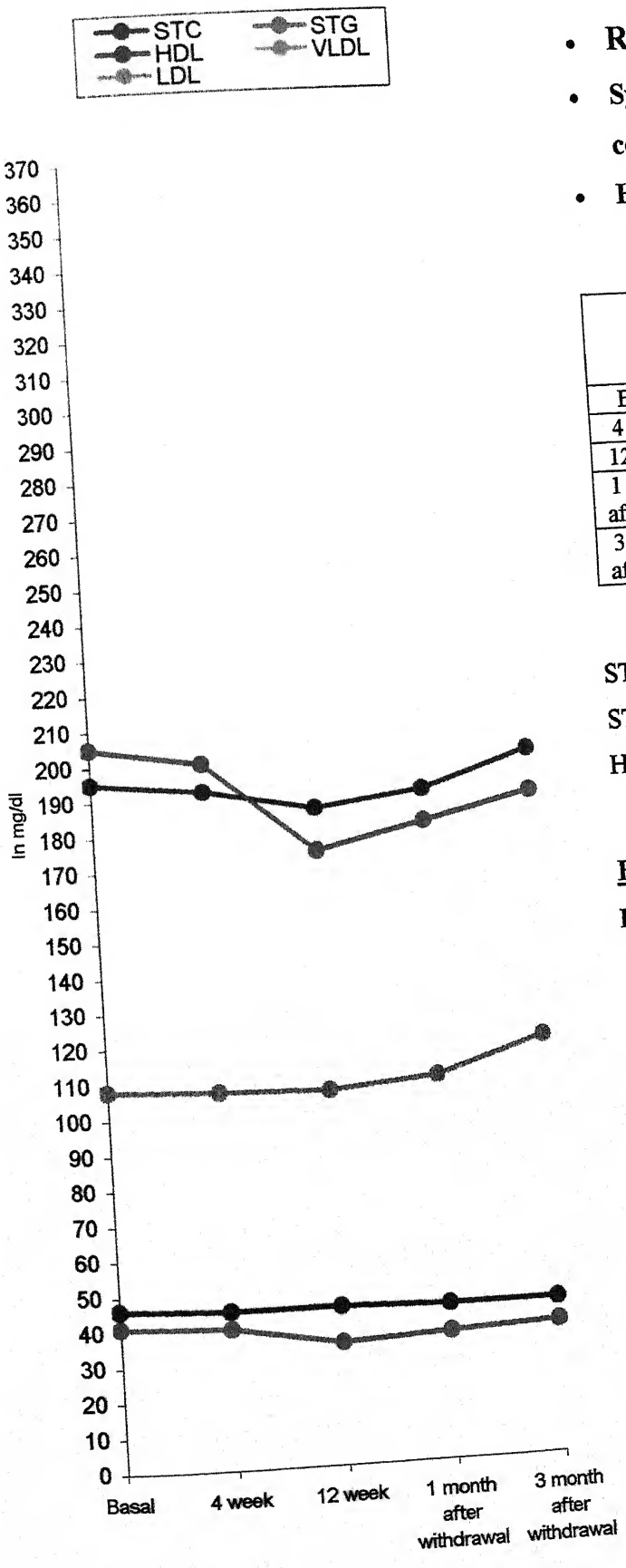
**After 4 weeks of treatment –**

5.2% ↓(STC), 2% ↓(STG),
4.7% ↑(HDL), 8% ↓(LDL)

**After 12 weeks of treatment –**

7.3% ↓ (STC), 2% ↓(STG),
4.7% ↑ (HDL), 10.9% ↓ (LDL)

# GARLIC PEARLS GROUP




- **Ramgopal K., 50 years/M**
- **Systemic hypertension with acute coronary syndrome**
- **Hypertriglyceridemia**

| | In mg/dl | | | | | |
|---|---|---|---|---|---|---|
| | STC | STG | HDL | VLDL | LDL | LDL/ HDL |
| Basal | 195 | 205 | 46 | 41 | 108 | 2.3:1 |
| 4 week | 192 | 200 | 45 | 40 | 107 | 2.4:1 |
| 12 week | 186 | 174 | 45 | 34.8 | 106.2 | 2.3:1 |
| 1 month after with* | 190 | 181 | 44 | 36.2 | 108.8 | 2.5:1 |
| 3 month after with* | 200 | 188 | 44 | 37.6 | 118.4 | 2.7:1 |

STC 1 mmol/L = 38.76 mg/dl

STG mmol/L = mg/dl × 0.0114

HDL mmol/L = mg/dl / 38.76

**Fasting values :**

**Basal –**

Normal STC, high STG,

Normal HDL and High LDL

**After 4 weeks of treatment –**

1.5% ↓(STC), 2.4% ↓(STG),

2.1% ↑(HDL), 0.92% ↓(LDL)

**After 12 weeks of treatment –**

4.6% ↓ (STC), 15.1% ↓(STG),

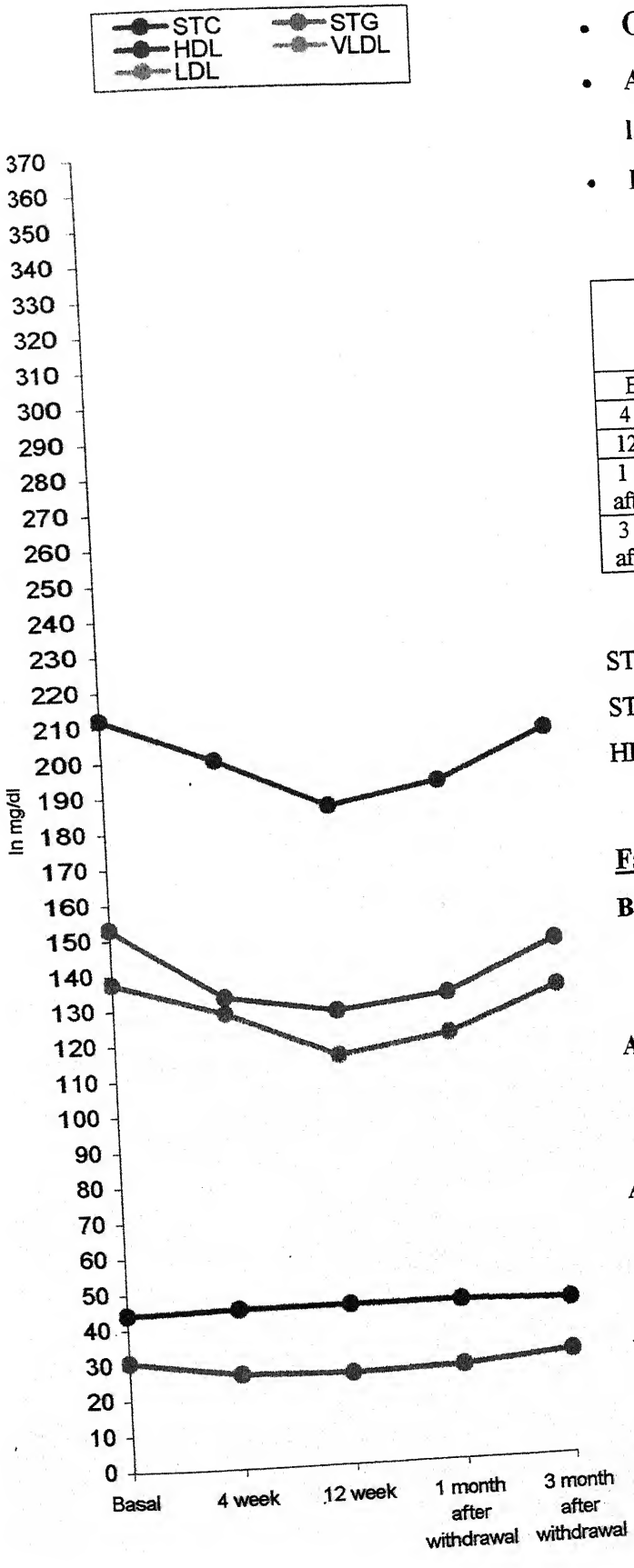
2.1% ↓ (HDL), 1.7% ↓ (LDL)

**After 3 months of withdrawal –**

2.5% ↑ (STC), 8.2% ↓(STG),

4.2% ↓ (HDL), 9.6% ↑ (LDL)

# GARLIC PEARLS GROUP




- **Omar Mohammad, 60 years/M**
- **Acute inferior wall MI with antero-lateral ischemia**
- **Hypercholesterolemia**

| | In mg/dl | | | | | |
|---|---|---|---|---|---|---|
| | STC | STG | HDL | VLDL | LDL | LDL/ HDL |
| Basal | 212 | 153 | 44 | 30.6 | 137.4 | 3.1:1 |
| 4 week | 200 | 133 | 45 | 26.6 | 128.4 | 2.8:1 |
| 12 week | 186 | 128 | 45 | 25.6 | 115.4 | 2.6:1 |
| 1 month after with | 192 | 132 | 45 | 26.4 | 120.6 | 2.7:1 |
| 3 month after with | 206 | 146 | 44 | 29.2 | 132.8 | 3.0:1 |

STC 1 mmol/L = 38.76 mg/dl

STG mmol/L = mg/dl × 0.0114

HDL mmol/L = mg/dl / 38.76

**Fasting values :**

**Basal –**

High STC, Normal STG,
Normal HDL and High LDL

**After 4 weeks of treatment –**

5.6% ↓(STC), 13% ↓(STG),
2.2% ↑(HDL), 6.5% ↓(LDL)

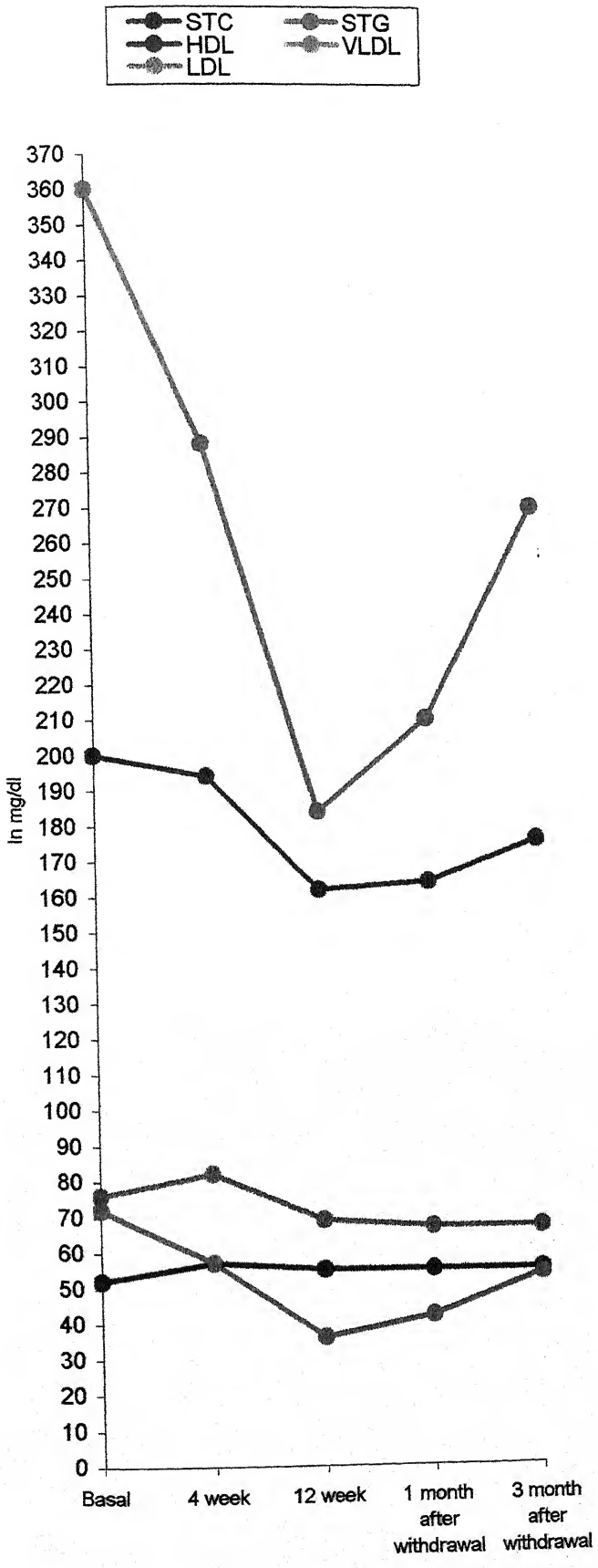
**After 12 weeks of treatment –**

12.26% ↓ (STC), 16.3% ↓(STG),
2.2% ↑ (HDL), 16% ↓ (LDL)

**After 3 months of withdrawal –**

2.8% ↓ (STC), 4.5% ↓(STG),
No change in HDL, 3.3% ↓ (LDL)

# SIMVASTATIN GROUP




- **Sunil Khattar, 53 years/M**
- **Diabetes Mellitus**
- **Hypercholesterolemia**
- **Hypertriglyceridemia**

| | In mg/dl | | | | | |
|---|---|---|---|---|---|---|
| | STC | STG | HDL | VLDL | LDL | LDL/ HDL |
| Basal | 200 | 360 | 52 | 72 | 76 | 1.4:1 |
| 4 week | 194 | 288 | 55 | 57 | 82 | 1.4:1 |
| 12 week | 162 | 184 | 57 | 36 | 69 | 1.2:1 |
| 1 month after with* | 164 | 210 | 55 | 42 | 67 | 1.2:1 |
| 3 month after with* | 176 | 270 | 55 | 54 | 67 | 1.2:1 |

STC 1 mmol/L = 38.76 mg/dl

STG mmol/L = mg/dl × 0.0114

HDL mmol/L = mg/dl / 38.76

**Fasting values :**

**Basal –**

High STC, High STG,

Normal HDL and Normal LDL

**After 4 weeks of treatment –**

3% ↓(STC), 20% ↓(STG),

5.8% ↑(HDL), 7.8% ↑(LDL)

**After 12 weeks of treatment –**

19% ↓ (STC), 48% ↓(STG),

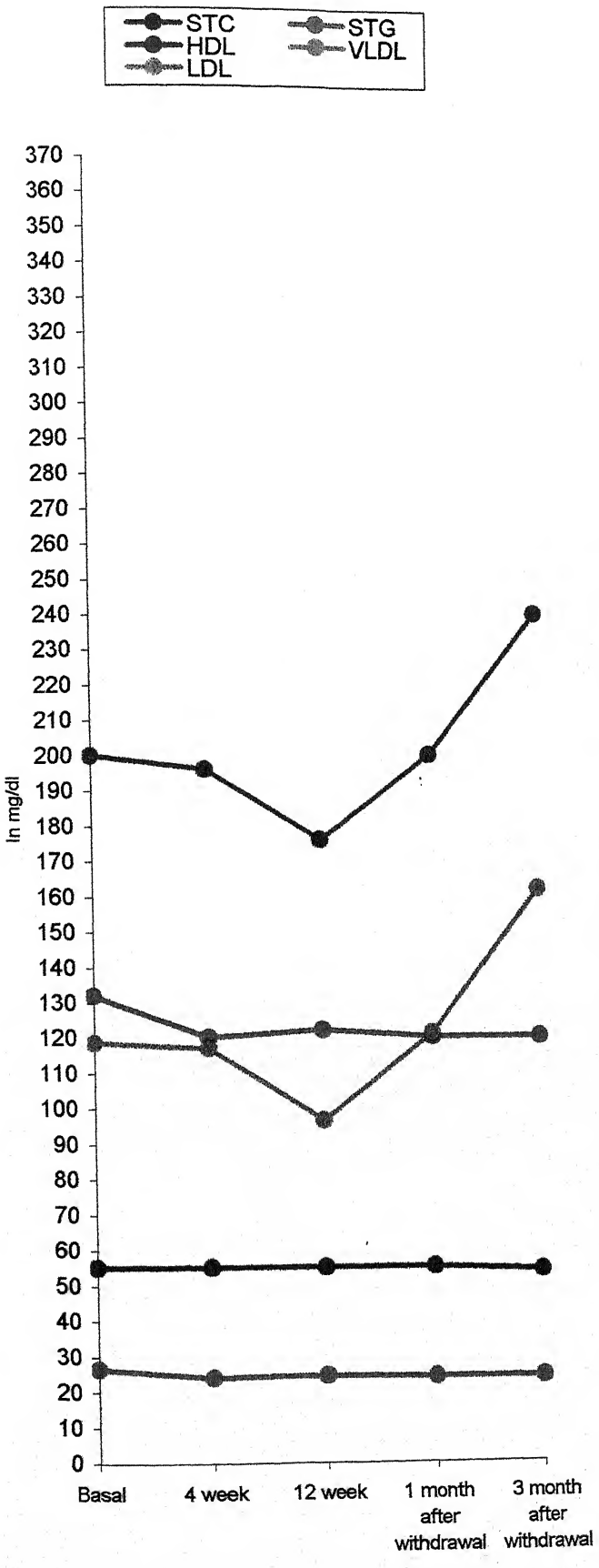
9.6% ↑ (HDL), 9.2% ↓ (LDL)

**After 3 months of withdrawal –**

12% ↓ (STC), 30% ↓(STG),

5.8% ↑ (HDL), 13.4% ↓ (LDL)

# SIMVASTATIN GROUP




- **Laxmi Bai, 60 years/F**
- **Diabetes mellitus with old anterior wall MI with diabetic nephropathy**
- **Hypercholesterolemia**

| | In mg/dl | | | | | |
|---|---|---|---|---|---|---|
| | STC | STG | HDL | VLDL | LDL | LDL/ HDL |
| Basal | 200 | 132 | 55 | 26.4 | 118.6 | 2.2:1 |
| 4 week | 196 | 120 | 55 | 24.0 | 117 | 2.2:1 |
| 12 week | 176 | 122 | 55 | 24.4 | 96.6 | 1.8:1 |
| 1 month after with* | 200 | 120 | 55 | 24.0 | 121 | 2.2:1 |
| 3 month after with* | 240 | 120 | 54 | 24.0 | 162 | 3:1 |

STC 1 mmol/L = 38.76 mg/dl

STG mmol/L = mg/dl × 0.0114

HDL mmol/L = mg/dl / 38.76

**Fasting values :**

**Basal –**

High STC, Normal STG,

Normal HDL and High LDL

**After 4 weeks of treatment –**

2% ↓(STC), 9.0% ↓(STG),

No change in HDL, 1.3% ↓(LDL)

**After 12 weeks of treatment –**

12% ↓ (STC), 7.5% ↓(STG),

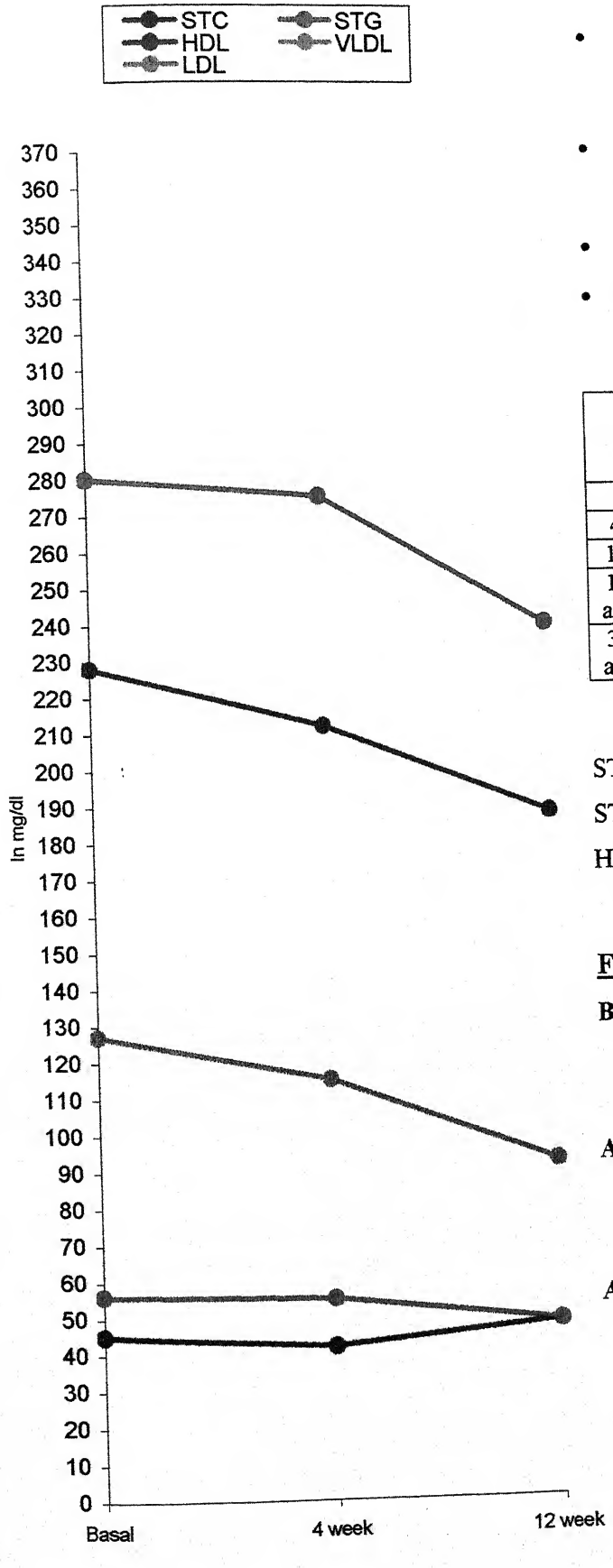
No change in HDL, 18.5% ↓ (LDL)

**After 3 months of withdrawal –**

20% ↑ (STC), 9.0% ↓(STG),

1.8% ↓ (HDL), 36.5% ↑ (LDL)

# SIMVASTATIN GROUP




- **Prabhudayal Yadav,**
  **40 years/M**
- **CAD, unstable angina, old inferior wall MI**
- **Hypercholesterolemia**
- **Hypertriglyceridemia**

| | In mg/dl | | | | | |
|---|---|---|---|---|---|---|
| | STC | STG | HDL | VLDL | LDL | LDL/ HDL |
| Basal | 228 | 280 | 45 | 56 | 127 | 2.8:1 |
| 4 week | 212 | 275 | 42 | 55 | 115 | 2.7:1 |
| 12 week | 188 | 240 | 48 | 48 | 92 | 1.9:1 |
| 1 month after with | - | - | - | - | - | - |
| 3 month after with | - | - | - | - | - | - |

STC 1 mmol/L = 38.76 mg/dl

STG mmol/L = mg/dl × 0.0114

HDL mmol/L = mg/dl / 38.76

**Fasting values :**

**Basal –**

High STC, High STG,
Normal HDL and High LDL

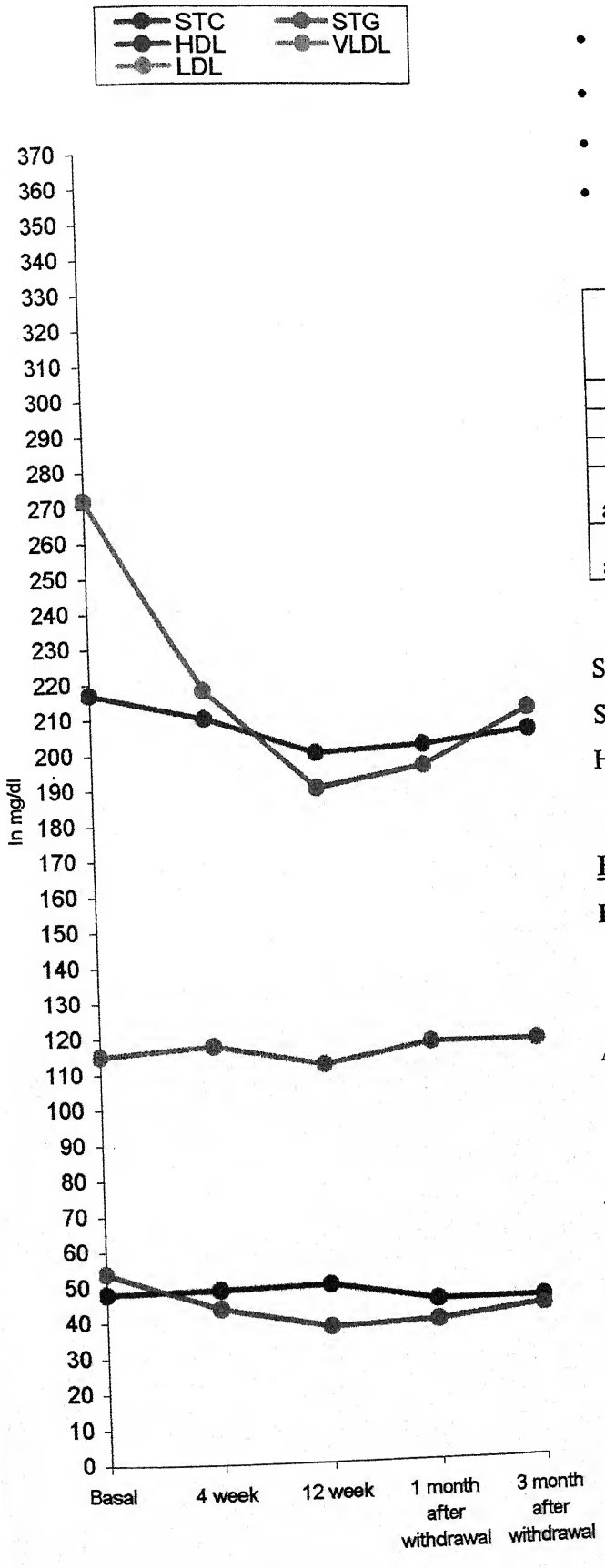
**After 4 weeks of treatment –**

7.0% ↓(STC), 1.7% ↓(STG),
6.6% ↓(HDL), 9.4% ↓(LDL)

**After 12 weeks of treatment –**

17.5% ↓ (STC), 14.2% ↓(STG),
6.6% ↑ (HDL), 27.5% ↓(LDL)

# SIMVASTATIN GROUP




- **Santosh Jain, 42 years/M**
- **Unstable angina**
- **Hypercholesterolemia**
- **Hypertriglyceridemia**

| | In mg/dl | | | | | |
|---|---|---|---|---|---|---|
| | STC | STG | HDL | VLDL | LDL | LDL/ HDL |
| Basal | 217 | 272 | 48 | 54.0 | 115.0 | 2.4:1 |
| 4 week | 210 | 218 | 49 | 43.6 | 117.4 | 2.4:1 |
| 12 week | 200 | 190 | 50 | 38.0 | 112.0 | 2.2:1 |
| 1 month after with* | 202 | 196 | 45 | 39.2 | 117.8 | 2.6:1 |
| 3 month after with* | 206 | 212 | 45 | 43.0 | 118.0 | 2.6:1 |

STC 1 mmol/L = 38.76 mg/dl

STG mmol/L = mg/dl × 0.0114

HDL mmol/L = mg/dl / 38.76

**Fasting values :**

**Basal –**

High STC, High STG,

Normal HDL and High LDL

**After 4 weeks of treatment –**

3.2% ↓(STC), 19.8% ↓(STG),

2.0% ↑(HDL), 2.0% ↑(LDL)

**After 12 weeks of treatment –**

8.5% ↓ (STC), 30% ↓(STG),

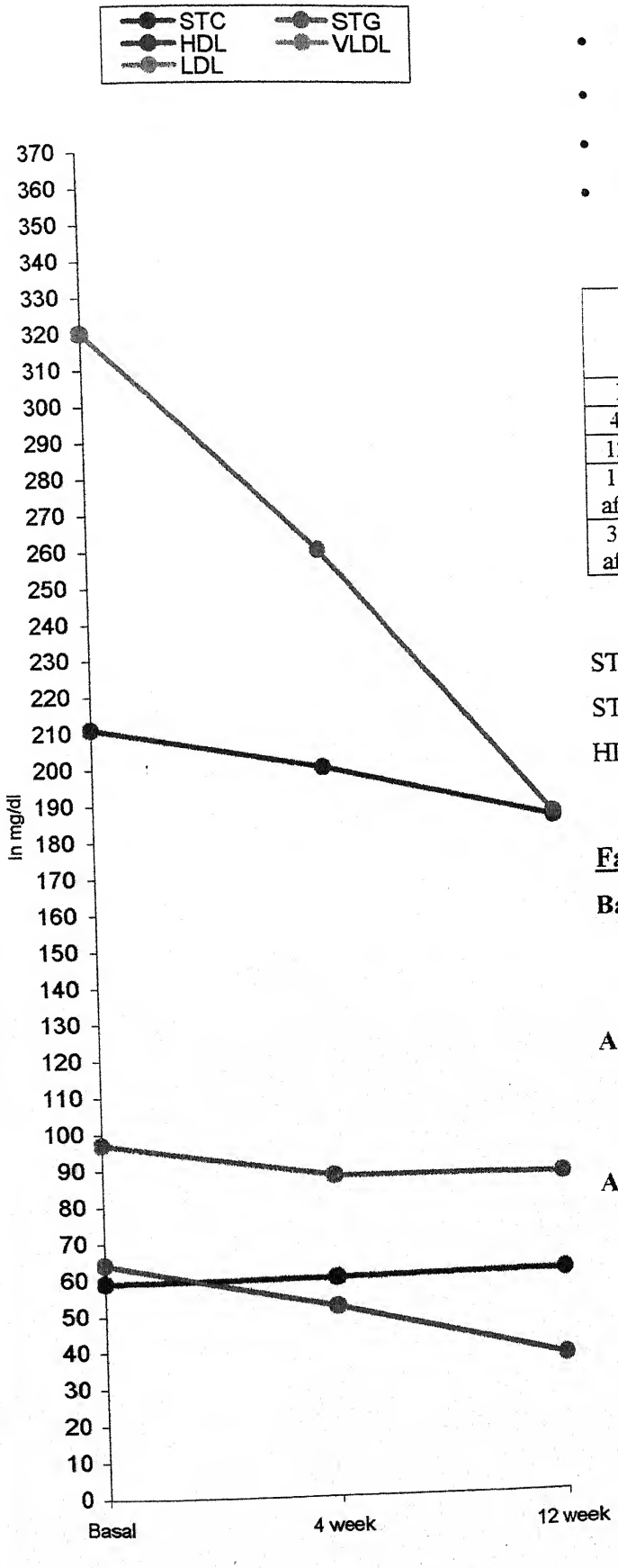
4.1% ↑ (HDL), 2.6% ↓(LDL)

**After 3 months of withdrawal –**

5.0% ↓ (STC), 22% ↓(STG),

6.25% ↓ (HDL), 2.6% ↑(LDL)

# SIMVASTATIN GROUP




- **Meera Bai, 36 years/F**
- **Stable angina**
- **Hypercholesterolemia**
- **Hypertriglyceridemia**

| | In mg/dl | | | | | |
|---|---|---|---|---|---|---|
| | STC | STG | HDL | VLDL | LDL | LDL/ HDL |
| Basal | 211 | 320 | 59 | 64 | 97 | 1.9:1 |
| 4 week | 200 | 260 | 60 | 52 | 88 | 1.4:1 |
| 12 week | 186 | 187 | 61 | 37.4 | 87.6 | 1.4:1 |
| 1 month after with* | - | - | - | - | - | - |
| 3 month after with* | - | - | - | - | - | - |

STC 1 mmol/L = 38.76 mg/dl

STG mmol/L = mg/dl × 0.0114

HDL mmol/L = mg/dl / 38.76

**Fasting values :**

**Basal –**

High STC, High STG,

Normal HDL and Normal LDL

**After 4 weeks of treatment –**

5.2% ↓(STC), 18.8% ↓(STG),

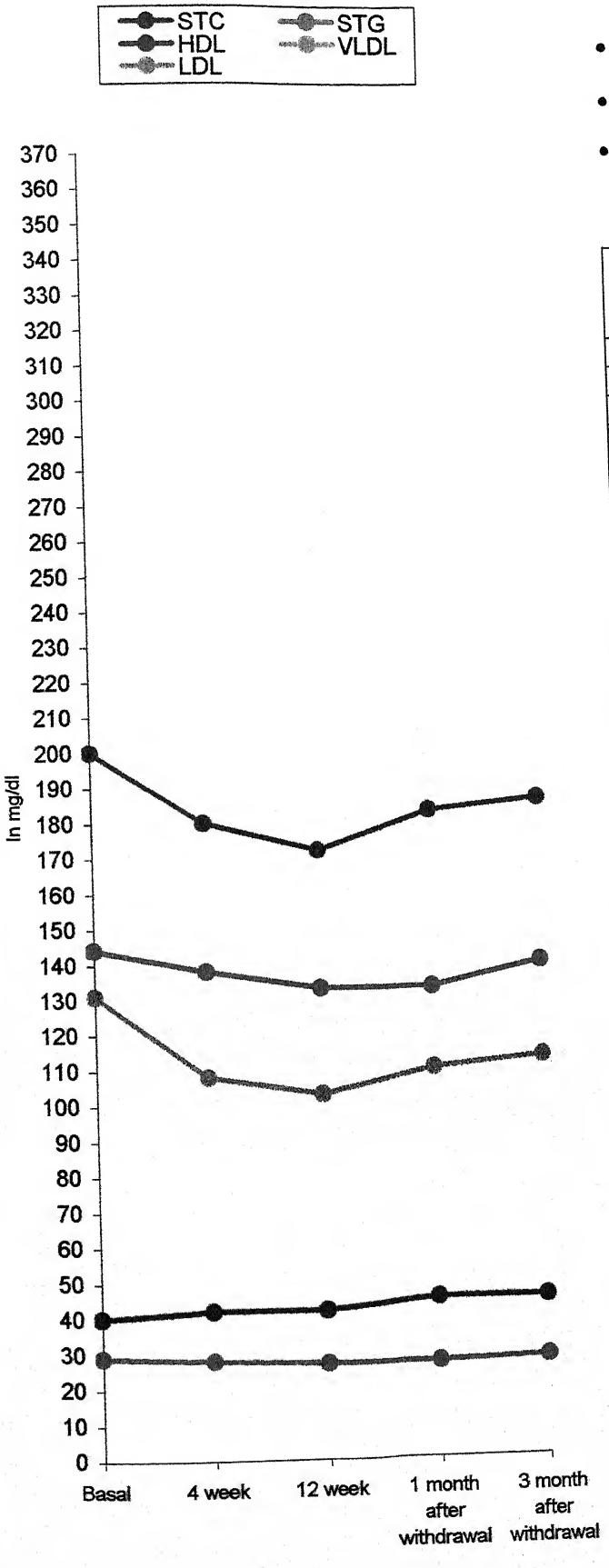
1.6% ↑(HDL), 9.27% ↓(LDL)

**After 12 weeks of treatment –**

11.8% ↓ (STC), 41.5% ↓(STG),

3.3% ↑ (HDL), 9.6% ↓ (LDL)

# SIMVASTATIN GROUP




- **Harnarayan, 50 years/M**
- **Anterior wall MI**
- **Hypercholesterolemia**

| | In mg/dl | | | | | |
|---|---|---|---|---|---|---|
| | STC | STG | HDL | VLDL | LDL | LDL/ HDL |
| Basal | 200 | 144 | 40 | 29 | 131 | 3.2:1 |
| 4 week | 180 | 138 | 42 | 28 | 108 | 2.6:1 |
| 12 week | 172 | 133 | 42 | 27 | 103 | 2.5:1 |
| 1 month after with* | 183 | 133 | 45 | 27 | 110 | 2.4:1 |
| 3 month after with* | 186 | 140 | 45 | 28 | 113 | 2.5:1 |

STC 1 mmol/L = 38.76 mg/dl

STG mmol/L = mg/dl × 0.0114

HDL mmol/L = mg/dl / 38.76

**Fasting values :**

**Basal –**

High STC, Low STG,

Normal HDL and High LDL

**After 4 weeks of treatment –**

10% ↓(STC), 4.1% ↓(STG),

5% ↑(HDL), 17.5% ↓(LDL)

**After 12 weeks of treatment –**

14% ↓ (STC), 7.6% ↓(STG),

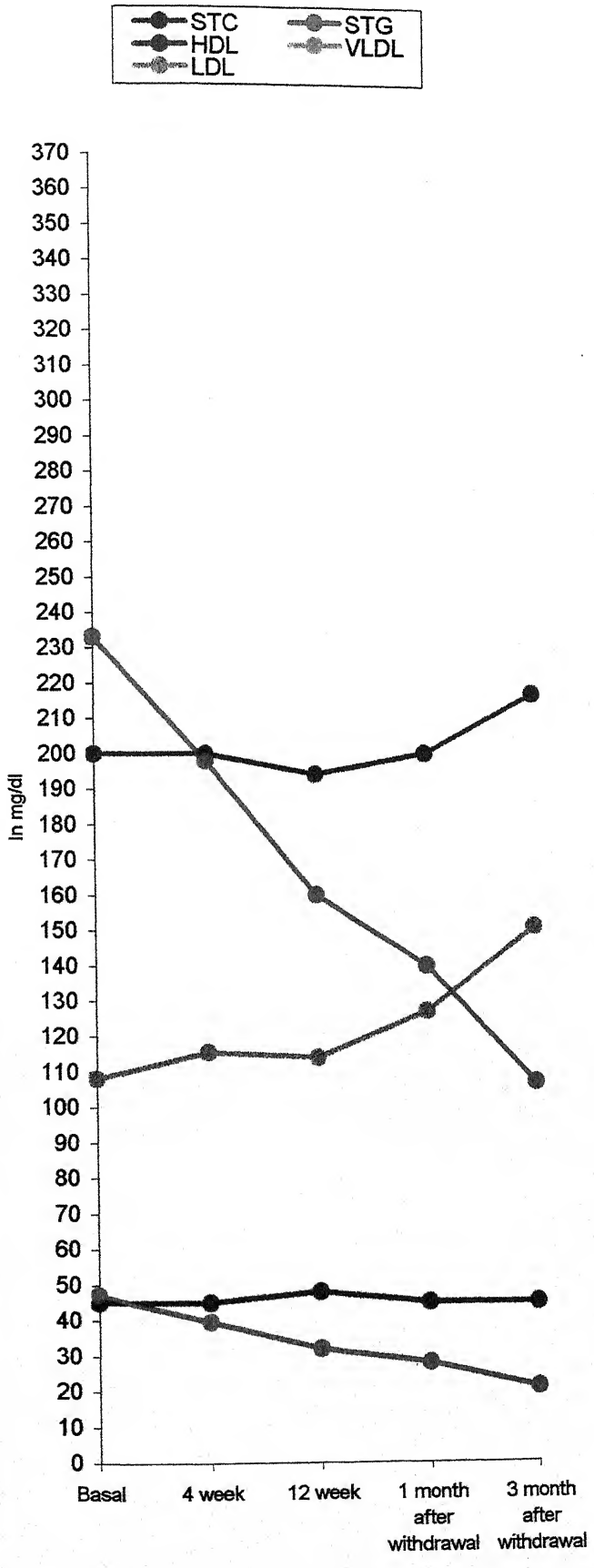
5% ↑ (HDL), 21.3% ↓ (LDL)

**After 3 months of withdrawal –**

7% ↓ (STC), 2.8% ↓(STG),

12.5% ↑ (HDL), 13.7% ↓ (LDL)

# SIMVASTATIN GROUP




- **D.C. Puneet, 68 years/M**
- **Systemic hypertension**
- **Hypercholesterolemia**
- **Hypertriglyceridemia**

| | In mg/dl | | | | | |
|---|---|---|---|---|---|---|
| | STC | STG | HDL | VLDL | LDL | LDL/ HDL |
| Basal | 200 | 233 | 45 | 47.0 | 108.0 | 2.4:1 |
| 4 week | 200 | 198 | 45 | 39.6 | 115.4 | 2.6:1 |
| 12 week | 194 | 160 | 48 | 32.0 | 114.0 | 2.3:1 |
| 1 month after with* | 200 | 140 | 45 | 28.0 | 127.0 | 2.8:1 |
| 3 month after with* | 217 | 107 | 45 | 21.0 | 151.0 | 3.3:1 |

STC 1 mmol/L = 38.76 mg/dl

STG mmol/L = mg/dl × 0.0114

HDL mmol/L = mg/dl / 38.76

**Fasting values :**

**Basal –**

High STC, High STG,

Normal HDL and High LDL

**After 4 weeks of treatment –**

No change in STC, 15% ↓(STG),

No change in HDL, 6.8% ↑(LDL)

**After 12 weeks of treatment –**

3% ↓ (STC), 31.3% ↓(STG),

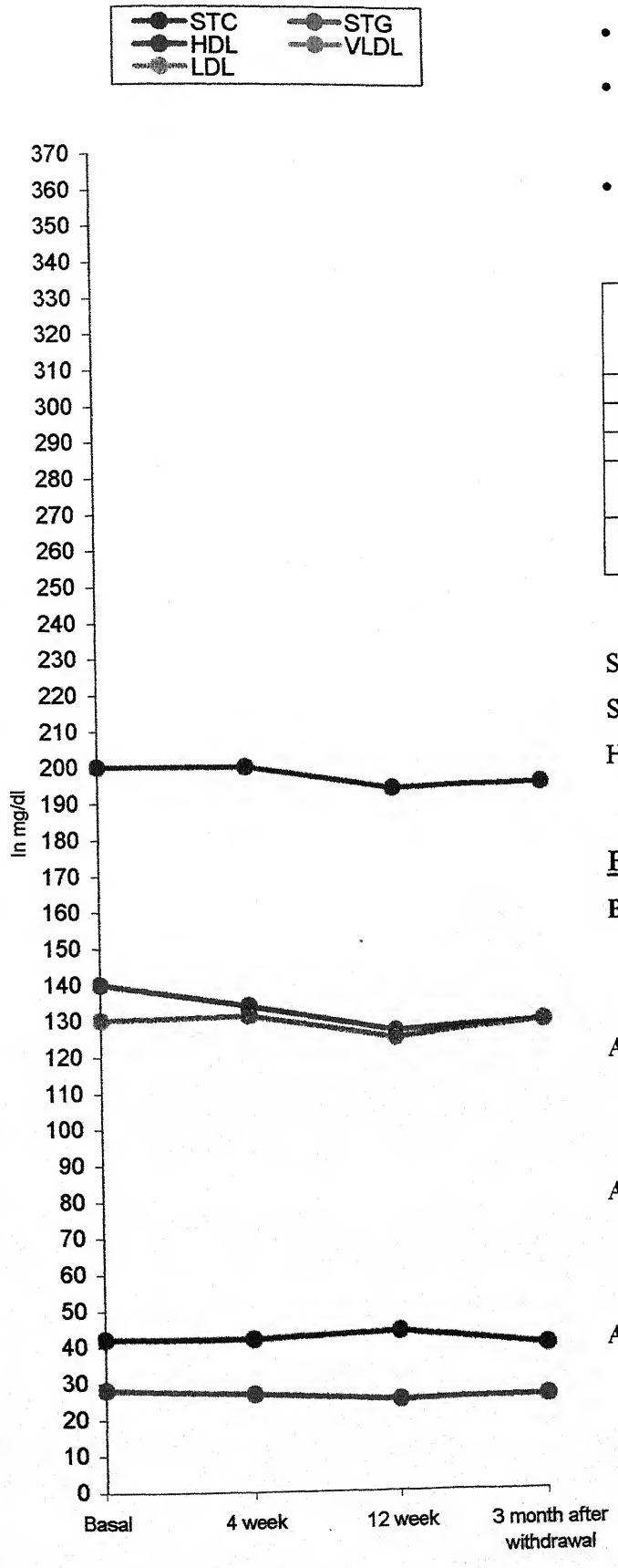
6.6% ↑ (HDL), 5.5% ↑ (LDL)

**After 3 months of withdrawal –**

8.5% ↑ (STC), 54% ↓(STG),

No change in HDL, 39.8% ↑ (LDL)

# SIMVASTATIN GROUP




- **K.V. Nayak, 43 years/M**
- **Acute inferior wall MI with systemic hypertension**
- **Hypercholesterolemia**

| | In mg/dl | | | | | |
|---|---|---|---|---|---|---|
| | STC | STG | HDL | VLDL | LDL | LDL/ HDL |
| Basal | 200 | 140 | 42 | 28.0 | 130.0 | 3:1 |
| 4 week | 200 | 134 | 42 | 26.8 | 131.2 | 3.1:1 |
| 12 week | 194 | 127 | 44 | 25.0 | 125.0 | 2.8:1 |
| 1 month after with | - | - | - | - | - | - |
| 3 month after with | 196 | 130 | 40 | 26 | 130 | 3.2:1 |

STC 1 mmol/L = 38.76 mg/dl

STG mmol/L = mg/dl × 0.0114

HDL mmol/L = mg/dl / 38.76

**Fasting values :**

**Basal –**

High STC, Normal STG,

Normal HDL and High LDL

**After 4 weeks of treatment –**

No change in STC, 4.2% ↓(STG),

No change in HDL, 0.92% ↑(LDL)

**After 12 weeks of treatment –**

3.1% ↓ (STC), 9.3% ↓(STG),

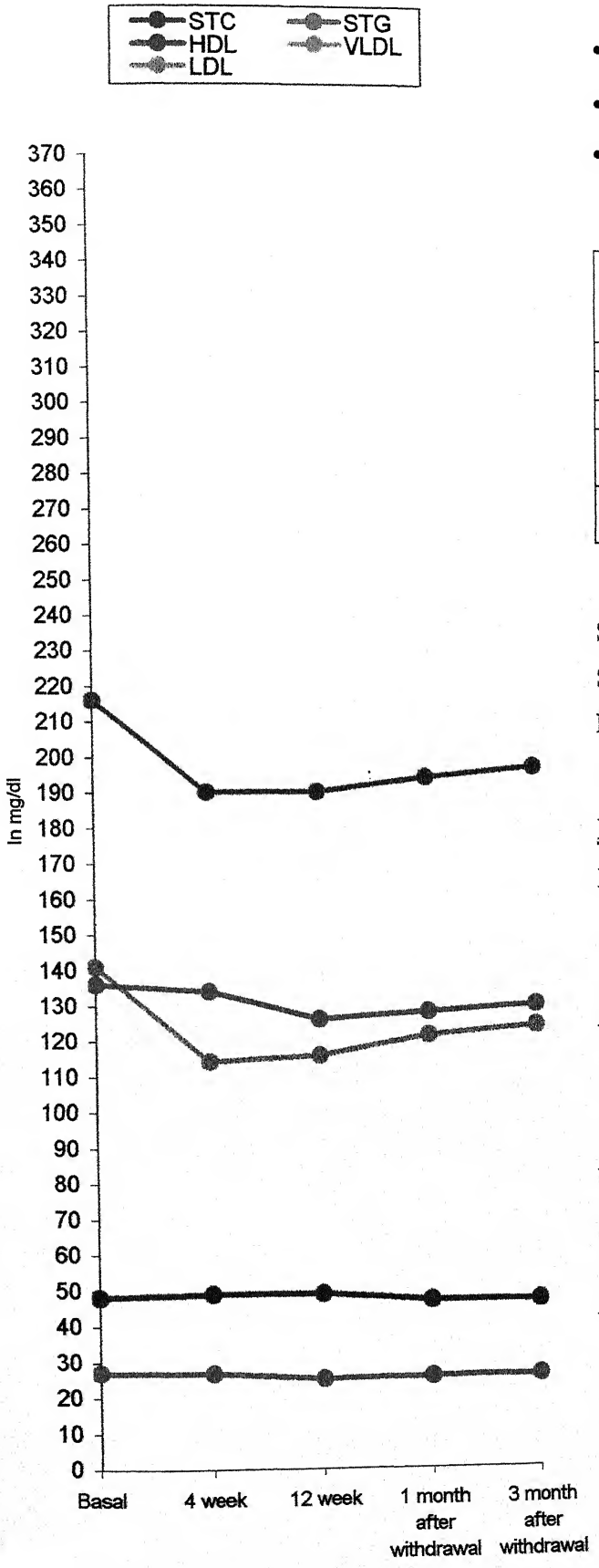
5% ↑ (HDL), 3.8% ↓ (LDL)

**After 3 months of withdrawal –**

2% ↓ (STC), 7.1% ↓(STG),

5% ↓ (HDL), No change in LDL

# SIMVASTATIN GROUP




- **Shiv dayal, 42 years/M**
- **Systemic hypertension**
- **Hypercholesterolemia**

| | In mg/dl | | | | | |
|---|---|---|---|---|---|---|
| | STC | STG | HDL | VLDL | LDL | LDL/ HDL |
| Basal | 216 | 136 | 48 | 27.0 | 141.0 | 2.9:1 |
| 4 week | 190 | 134 | 49 | 26.8 | 114.2 | 2.3:1 |
| 12 week | 190 | 126 | 49 | 25.2 | 115.8 | 2.4:1 |
| 1 month after with* | 194 | 128 | 47 | 25.6 | 121.4 | 2.6:1 |
| 3 month after with* | 197 | 130 | 47 | 26.0 | 124.0 | 2.6:1 |

STC 1 mmol/L = 38.76 mg/dl

STG mmol/L = mg/dl × 0.0114

HDL mmol/L = mg/dl / 38.76

**Fasting values :**

**Basal –**

High STC, Normal STG,

Normal HDL and High LDL

**After 4 weeks of treatment –**

12.03% ↓(STC), 1.47% ↓(STG),

2.08% ↑(HDL), 19.0% ↓(LDL)

**After 12 weeks of treatment –**

12.03% ↓ (STC), 7.4% ↓(STG),

2.08% ↑ (HDL), 17.9% ↓ (LDL)

**After 3 months of withdrawal –**

8.8% ↓ (STC), 4.4% ↓(STG),

2.08% ↓ (HDL), 12.05% ↓ (LDL)

# *Discussion*

# DISCUSSION

This work was conducted in the department of Medicine, M.L.B. Medical College, Jhansi on patients suffering from systemic hypertension, Diabetes Mellitus, Ischemic Heart Disease, Myocardial Infarction or Nephrotic syndrome having hypercholesterolemia (>200mg/dl), hypertriglyceridemia (>200mg/dl) or both.

**The Changes in Serum total cholesterol (STC) :**

The values obtained were compared with the basal values.

**Group A (Raw garlic group) :**

The mean basal fasting values of the patients in this group was 223.2±28.45 while the values after 4 and 12 weeks of treatment and after 3 months of withdrawal are 208.4±27.08, 197.8±11.76, 211.0±17.52 respectively, while the percentage decrease from the mean basal values are 6.74%, 9.43% and 3.05% respectively.

**Group B (Garlic pearls group) :**

The mean basal fasting values of the patients in this group was 211.8±21.48 while the values after 4 and 12 weeks of treatment and after 3 months of withdrawal are 201.1±19.49, 191±15.50, 201.3±11.55 respectively while the percentage decrease from the

mean basal values are 4.99%, 7.74%, 3.02% respectively. Two subjects after 3 months of withdrawal have even showed an increase in STC from basal value i.e. average 4%.

**Group C (Simvastatin Group) :**

The mean basal fasting values of STC of the patients in this group was 208±10.45. The values after 4 and 12 weeks of treatment and after 3 month of withdrawal are 198±9.8, 184.6±12.24, 202.6±21.11 respectively while the percentage decrease from mean basal values are 6.06% (In 2 subjects no change is observed), 11.21%, 6.96% (In 2 subjects values increase more than basal value by an average of 14.25%) respectively.

On statistical analysis we found that the serum cholesterol lowering effect of raw garlic and garlic pearls were statistically insignificant ($P>0.05$ in both groups) but the cholesterol lowering effect of simvastatin was statistically very significant ($P<0.001$) after 12 weeks of treatment. After 3 months of withdrawal cholesterol lowering effect in all the three groups was insignificant.

**The Changes in Serum triglyceride (STG) :**

**Group A (Raw garlic group) :**

The mean basal fasting values of STG of patients in this group was 180.6±79.40. The values after 4 and 12 weeks of treatment and

after 3 months of withdrawal are 171.5±64.06, 149.2±59.52, 161.2±67.67 respectively while the percentage decrease from mean basal values are 10.05%, 20.58%, 10.86% respectively. Although 2 patients in this group showed an increase in STG levels by 10.15%, 2.0% and 10.7% respectively.

**Group B (Garlic pearls group)**

The mean basal fasting value of STG of patients in this group was 169.8±47.71 while the values after 4 and 12 weeks of treatment and after 3 months of withdrawal are 156.3±44.71, 141.8±33.83, 162.3±41.99 respectively while the percentage decrease from mean basal values are 9.91% (2 subjects showed no change), 18.31% and 14.33% respectively.

**Group C (Simvastatin group) :**

The mean basal fasting values of STG of patients in this group was 224.1±88.66 while the value after 4 and 12 weeks of treatment and after 3 months of withdrawal are 196.1±67.19, 163.2±40.10, 158.4±55.30 respectively, while the percentage decrease from the mean basal values are 10.46%, 21.88% and 18.47% respectively.

On statistical analysis lowering of STG by raw garlic ($P>0.4$) garlic pearls ($P>0.2$) and of simvastatin ($P>0.05$) after 12 weeks of

treatment remain insignificant. After 3 months of withdrawal lowering effect of STG remain statistically insignificant.

**The Changes in High density lipoprotein (HDL) :**

**Group A (Raw garlic group) :**

The mean basal fasting value of HDL in this group was 43.7±7.56 while the values after 4 and 12 weeks of treatment and after 3 months of withdrawal are 43.3±7.47, 41.7±7.20, 41.0±10.22 respectively.

**After 4 weeks -** HDL was decreased by 2.07%. 3 subjects showed no change and one subject showed an increase by 3.8%.

**After 12 weeks -** HDL found to decrease by 2.15%, 2 subjects showed no change and 2 subjects showed 4.3% increase.

**After 3 months of withdrawal -** Subjects showed 2.15% decrease in HDL 3 subjects showed no change.

**Group B (Garlic pearls group) :**

The mean basal fasting value of subjects in this group was 43.6±1.87 while after 4 and 12 weeks of treatment and 3 months of withdrawal are 44.5±1.01, 45±1.73, 44.2±0.98 respectively.

**After 4 weeks -** Subjects showed 5.5% increase while 1 subject showed no change and 2 subjects showed fall by 4.4%.

**After 12 weeks -** Subjects showed increase by 6.62%, 2 subjects showed fall by 4.35%.

**After 3 months of withdrawal -** Subjects showed increase by 4.8%, 1 subject showed no change and 2 subjects showed decrease by 3.2%.

**Group C (Simvastatin group) :**

The mean basal fasting value of HDL of subjects in this group was 48.2±6.17, while after 4 and 12 weeks of treatment and after 3 months of withdrawal are 48.8±6.66, 50.4±6.14, 47.3±5.38 respectively.

**After 4 weeks -** Subjects showed an increase by 3.29%, 3 subjects showed no change and a fall by 6.6% in 1 subject.

**After 12 weeks -** Subjects showed an increase by 5.28%. No change in one subject.

**After 3 months of withdrawal -** Subjects showed increase by 9.15%, 1 subject no change and in 4 subjects decrease by 3.78%.

On analysis changes in HDL are statistically insignificant in all the three groups, after 4 and 12 weeks of treatment and after 3 months of withdrawal.

**The Changes in Very Low Density Lipoprotein (VLDL) :**

**Group A (Raw garlic group) :**

The mean basal fasting value of VLDL in subjects of this group was 36.1±15.82, while the values after 4 and 12 weeks of treatment and after 3 months of withdrawal are 34.3±12.81, 29.8±11.98, 32.2±13.53 respectively.

**Group B (Garlic Pearls group) :**

The mean basal fasting values of the VLDL in subjects of this group was 33.8±9.48, while the values after and 12 weeks of treatment and after 3 months of withdrawal are 31.2±8.98, 28.4±6.88, 32.5±7.10 respectively.

**Group C (Simvastatin group) :**

The mean basal fasting values of the VLDL in subjects of this group was 44.8±17.72, while the values after 4 and 12 weeks of treatment and after 3 months of withdrawal are 39.2±13.29, 32.5±8.00, 31.7±12.09 respectively.

On analysis the changes in VLDL i.e. the decrease in all the three groups are statistically insignificant, after 4 and 12 weeks of treatment and after 3 months of withdrawal.

**The Changes in LDL (Low Density Lipoprotein) :**

**Group A (Raw Garlic group) :**

The mean basal fasting value of LDL in subjects of this group was 143.3±21.53, while the values after 4 and 12 weeks of treatment and after 3 months of withdrawal are 131.5±18.13, 126.4±13.24, 137.8±18.35 respectively.

After 4 weeks subjects showed decrease by 8.75% except one subject who showed increase by 1.09%.

After 12 weeks subjects showed decrease by 15.87%, in 2 subjects increase by 0.445%.

After 3 months of withdrawal the fall remained to 6.13% and in 2 subjects an increase was noted by 4.0%

**Group B (Garlic Pearls group)**

The mean fasting value of LDL in this group was 134.4±30.17, while after 4 and 12 weeks of treatment and after 3 months of withdrawal are 125.4±26.97, 117.6±21.87, 124.6±18.76 respectively.

**After 4 weeks of treatment -** Subjects showed a fall by 7.36%, in 1 subject an increase by 0.97% was noted.

**After 12 weeks of treatment -** Fall by 9.55%, in 1 subject an increase by 0.97% was noted.

**After 3 months of withdrawal-** Only 2 subjects showed a fall by 4.85%, rest of the subjects showed a rise by 6.65%.

**Group C( Simvastatin group)**

The mean basal fasting value of LDL of subjects in this group was 115.9±19.99, while after 4 weeks and 12 weeks of treatment and after 3 months of withdrawal are 109.8±15.39, 101.7±17.28, 123.6±30.58 respectively.

**After 4 weeks of treatment -** LDL decreased by 11.29% in 5 subjects and 4.38% increase was noted in 4 subjects.

**After 12 weeks of treatment –** Decrease of 13.81% was noted, in 1 subject increase by 5.5% was noted.

**After 3 months of withdrawal -** LDL fall of 13.05% was noted, 1 subject showed no change and 3 subjects showed an average increase of 26.3%.

On statistical analysis the changes in LDL i.e. the lowering effect of LDL in all the three groups was statistically insignificant, after 4 and 12 weeks of treatment. Values remain insignificant after 3 months of withdrawal.

The present study does not substantiate the lipid lowering effect of raw garlic or garlic pearls as lowering of serum total cholesterol is statistically insignificant.

A study conducted by **Arora RC, Arora S et al (1981)** at the Department of Medicine, M.L.B. Medical College, Jhansi; substantiated the similar conclusion that the STC rise after fat intake was not prevented by intake of garlic. Their published data indicated that garlic had no effect of STC[1].

A similar study conducted by **Arora RC, Arora S, Gupta RK et al** at M.L.B. Medical College and Hospital, Jhansi i.e. "**The long term use of garlic in ischemic heart disease**" showed marginal fluctuation in STC after garlic pearls. Statistical analysis of their mean gave insignificant P values[6].

The present study has shown that few subjects while on raw garlic revealed an increase of serum triglyceride instead of a fall.

We know that increase carbohydrate in diet lead to increase in plasma triglyceride levels. It may have been possible that when we tried to restrict subjects on routine diets not rich in fat and cholesterol some subjects may have increased carbohydrate in their diet hence result we found were inconsistent.

Secondly study conducted by **Arora RC, Arora S, Gupta RK, et al**[6] showed in their published data the levels STG have risen twice during the period of garlic use from the mean basal values. statistical analysis were found to be insignificant which is similar to the present study.

Thirdly meta- analysis by **Neil, CA Silagy**[33] had shown that TG levels ranges from (1.24-2.10 mmol/L) at baseline to (0.94-2.34 mmol/L) after garlic therapy. Henceforth it reveals that STG had raised in few subjects.

Fourthly **Steiner, et al**[32] had reported that there was a transient elevations in total cholesterol and triacylglycerol concentrations during initial supplementation this was later followed by a significant reduction below baseline levels.

In our study we found no statistically significant change in the level of HDL. Few subjects showed a decrease in HDL levels, while on raw garlic or garlic pearls.

A study showed that large intake of carbohydrates lead to increase in triglyceride levels and decrease in HDL levels. As Indians consume large carbohydrate diet and that would be the cause of fall of HDL level.

Meta-analysis of **Neil, CA Silagy**[33] had shown an insignificant rise of HDL, 1.14±0.27 mmol/L to 1.21±0.30 mmol/L, similar to the present study.

In present study LDL showed inconsistent results with statistically insignificant fall with increase in few subjects while on raw garlic or garlic pearls.

Similar results of increase in LDL level and insignificant P value was shown by **Arora RC, Arora S, Gupta RK et al**.

A large meta-analysis conducted by **Neil, CA Silagy, T Lancaster, J Hodgeman et al** published in the Journal of the Royal College of Physicians of London Vol 30, No-4, 1996 had shown that levels of LDL had increased after garlic therapy from 5.08±0.56 o 5.14±0.69 mmol/L.

As one subject in present study had shown a rise in LDL after 4 weeks and then a fall. **Steiner, et al**[32] had reported that there was a transient elevation of STC, STG and the ratio of LDL to very low density lipoprotein followed by a fall while on garlic therapy.

Similar to the present study, **Leon A, Simon et al** concluded in his study that garlic powder tablets appeared to have no significant effect on lipid lipoprotein profile.

The present study concluded that the cholesterol lowering effect of simvastatin is very significant ($p<0.001$) which is similar to the 4S study[50] conducted on simvastatin.

Lowering of STG by simvastatin is 21.88% in present study after 12 weeks of treatment which is within the range of drop of STG by statins in the report published by NCEP Adult treatment Panel-III[61].

Increase in HDL by simvastatin was found to be 5.248% which is within the range of HDL increase by statins as published in the report of NCEP-Adult treatment Panel-III[61]. Fall shows by one subject has an explanation similar to the above as in raw garlic and garlic pearls group.

The drop in the LDL level was 13.8% after 12 weeks of simvastatin therapy lower than the drop shown by NCEP – Adult treatment Panel-III[61] report and 4S[50] study group but most of the patients had achieved the goal of LDL <100mg/dl. Remaining subjects could have achieved the goal with higher dose of simvastatin which had not been given to the subjects of the present study.

Fasting values of the three groups i.e. Raw garlic, Garlic pearls and simvastatin at basal, after 12 weeks of treatment and after 3 months of withdrawal are :

| | Results (Mean ±SD) in mg/dl | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Raw Garlic Group | | | Garlic Pearls Group | | | Simvastatin Group | | |
| | Basal | 12 weeks | After 3 months of withdrawal | Basal | 12 weeks | After 3 months of withdrawal | Basal | 12 weeks | After 3 months of withdrawal |
| STC | 223.2± 28.45 | 197.8± 11.76 | 211.0± 17.52 | 211.8± 21.48 | 191.0± 15.50 | 201.3± 11.55 | 208.0± 10.45 | 184.6± 12.24 | 202.6± 21.11 |
| STG | 180.6± 79.40 | 149.2± 59.52 | 161.2± 67.67 | 169.8± 47.71 | 141.8± 33.83 | 162.3± 41.99 | 224.1± 88.66 | 163.2± 40.10 | 158.4± 55.30 |
| HDL | 43.7± 7.56 | 41.7± 7.20 | 41.0± 10.22 | 43.6± 1.87 | 45.0± 1.73 | 44.2± 0.98 | 48.2± 6.7 | 50.4± 6.14 | 47.3± 5.38 |
| VLDL | 36.1± 15.82 | 29.8± 11.98 | 32.2± 13.53 | 33.8± 9.48 | 28.4± 6.88 | 32.5± 7.10 | 44.8± 17.72 | 32.5± 8.00 | 31.7± 12.09 |
| LDL | 143.3± 21.53 | 126.4± 13.24 | 137.8± 18.35 | 134.4± 30.17 | 117.6± 21.87 | 124.6± 18.76 | 115.9± 19.99 | 101.7± 17.28 | 123.6± 30.58 |

# *Summary & Conclusion*

# SUMMARY AND CONCLUSION

This study consisted of 27 subjects which were randomly being grouped into three groups, each group comprised of 9 subjects. Individuals who were hypercholesterolemic (>200mg/dl) or were having high serum triglyceride level (>200 mg/dl) or both were selected for the study. Individuals of group A were counselled to take one clove of raw garlic per day. Subjects of group B were counselled to take 4 garlic pearls (each capsule containing 0.625mg of garlic oil, i.e. garlic oil 0.25% w/w excipients qs to 250mg). Individuals of group C were counselled to take simvastatin 20mg per day.

Changes in serum total cholesterol in the simvatatin group was statistically very significant ($p<0.001$) after 12 weeks of treatment. No significant effect was found in the raw garlic and garlic pearls group although the levels decreased after 12 weeks of treatment.

No significant effect was found in the levels of STG, HDL and LDL in any of the group after 12 weeks of treatment.

After 3 months of withdrawal the values of STC, STG, LDL and HDL remain statistically insignificant in all the three groups.

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# *Master Charts*

# MASTER CHART

[Group A - Raw Garlic (STC)]

| Result in mg/dl | | | | | | | |
|---|---|---|---|---|---|---|---|
| S.No. | Name | Age/ Sex | 1 (Basal) At Regis. | 2 4 week | 3 12 week | 4 1 month after withdrawal | 5 3 month after with-drawal |
| 1 | Puttan | 40/M | 258 | 226 | 213 | 227 | 240 |
| 2 | Premdubey | 46/F | 206 | 186 | 182 | - | - |
| 3 | Ragvendra Sharma | 68/M | 200 | 186 | - | - | 192 |
| 4 | Madan Mohan Soni | 41/M | 217 | 210 | 207 | 210 | 215 |
| 5 | Raja Bai | 52/F | 213 | 200 | - | - | - |
| 6 | Ram Rati | 40/F | 281 | 267 | - | - | - |
| 7 | Lila Devi | 60/F | 212 | 198 | 191 | 200 | 210 |
| 8 | Shanti Devi | 65/F | 202 | 194 | 190 | 196 | 198 |
| 9 | Dinesh Kumar Gupta | 43/M | 220 | - | 204 | - | - |
| Mean± SD | | 50.5± 10.6yrs | 223.2 ±28.45 | 208.4 ±27.08 | 197.8 ±11.76 | 208.3 ±13.81 | 211.0 ±17.52 |

(Statistical analysis of STC)

| | **Between I & II** (Basal & After 4wks of treatment) | **Between I & III** (Basal & After 12wks of treatment) | **Between I & V** (Basal & After 3 months of withdrawal) |
|---|---|---|---|
| 't' value | 1.131 | 2.053 | 0.899 |
| DF (degree of freedom | 15 | 13 | 12 |
| P value | >0.2 | >0.05 | >0.3 |
| Remark | Insignificant | Insignificant | Insignificant |

## [Group A – Raw Garlic (STG)]

| S.No. | Name | Age/ Sex | 1 (Basal) At Regis. | 2 4 week | 3 12 week | 4 1 month after withdrawal | 5 3 month after with-drawal |
|---|---|---|---|---|---|---|---|
| | | Result in mg/dl | | | | | |
| 1 | Puttan | 40/M | 141 | 160 | 156 | 157 | 159 |
| 2 | Premdubey | 46/F | 166 | 142 | 134 | - | - |
| 3 | Ragvendra Sharma | 60/M | 123 | 118 | - | - | 121 |
| 4 | Madan Mohan Soni | 41/M | 160 | 140 | 107 | 120 | 136 |
| 5 | Raja Bai | 52/F | 162 | 160 | - | - | - |
| 6 | Ram Rati | 40/F | 300 | 262 | - | - | - |
| 7 | Lila Devi | 60/F | 103 | 110 | 107 | 109 | 112 |
| 8 | Shanti Devi | 65/F | 331 | 280 | 265 | 270 | 278 |
| 9 | Dinesh Kumar Gupta | 43/M | 140 | - | 126 | - | - |
| Mean± SD | | 50.5± 10.6yrs | 180.6± 79.40 | 171.5± 64.06 | 149.2± 59.52 | 164.0 ± 73.58 | 161.2 ± 67.67 |

## (Statistical analysis of STG)

| | **Between I & II** (Basal & After 4wks of treatment) | **Between I & III** (Basal & After 12wks of treatment) | **Between I & V** (Basal & After 3 months of withdrawal) |
|---|---|---|---|
| 't' value | 0.257 | 0.823 | 0.459 |
| DF (degree of freedom | 15 | 13 | 12 |
| P value | >0.8 | >0.4 | >0.6 |
| Remark | Insignificant | Insignificant | Insignificant |

[Group A - Raw Garlic (HDL)]

| Result in mg/dl | | | | | | | |
|---|---|---|---|---|---|---|---|
| S.No. | Name | Age/ Sex | 1 (Basal) At Regis. | 2 4 week | 3 12 week | 4 1 month after withdrawal | 5 3 month after with-drawal |
| 1 | Puttan | 40/M | 46 | 45 | 45 | 44 | 45 |
| 2 | Premdubey | 46/F | 42 | 42 | 44 | - | - |
| 3 | Ragvendra Sharma | 68/M | 45 | 44 | - | - | 44 |
| 4 | Madan Mohan Soni | 41/M | 45 | 45 | 45 | 45 | 45 |
| 5 | Raja Bai | 52/F | 45 | 45 | - | - | - |
| 6 | Ram Rati | 40F | 55 | 54 | - | - | - |
| 7 | Lila Devi | 60/F | 45 | 44 | 44 | 44 | 45 |
| 8 | Shanti Devi | 65/F | 26 | 27 | 27 | 26 | 26 |
| 9 | Dinesh Kumar Gupta | 43/M | 45 | - | 45 | - | - |
| Mean± SD | | 50.5± 10.6yrs | 43.7± 7.56 | 43.3± 7.47 | 41.7± 7.20 | 39.8± 9.06 | 41.0± 10.22 |

(Statistical analysis of HDL)

| | **Between I & II** (Basal & After 4wks of treatment) | **Between I & III** (Basal & After 12wks of treatment) | **Between I & V** (Basal & After 3 months of withdrawal) |
|---|---|---|---|
| 't' value | 0.209 | 0.511 | 0.547 |
| DF (degree of freedom | 15 | 13 | 12 |
| P value | >0.8 | >0.6 | >0.5 |
| Remark | Insignificant | Insignificant | Insignificant |

## [Group A – Raw Garlic (VLDL)]

| Result in mg/dl | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 |
| S.No. | Name | Age/ Sex | (Basal) At Regis. | 4 week | 12 week | 1 month after withdrawal | 3 month after with-drawal |
| 1 | Puttan | 40/M | 28 | 32 | 31.2 | 31.4 | 31.8 |
| 2 | Premdubey | 46/F | 33 | 28.4 | 26.8 | - | - |
| 3 | Ragvendra Sharma | 68/M | 25 | 23.6 | - | - | 24.2 |
| 4 | Madan Mohan Soni | 41/M | 32 | 28 | 21 | 24 | 27.2 |
| 5 | Raja Bai | 52/F | 32 | 32 | - | - | - |
| 6 | Ram Rati | 40/F | 60 | 52.4 | - | - | - |
| 7 | Lila Devi | 60/F | 21 | 22 | 21.8 | 21.8 | 22.4 |
| 8 | Shanti Devi | 65/F | 66.2 | 56 | 53 | 54 | 55.6 |
| 9 | Dinesh Kumar Gupta | 43/M | 28 | - | 25.2 | - | - |
| Mean± SD | | 50.5± 10.6yrs | 36.1± 15.82 | 34.3 ± 12.81 | 29.8± 11.98 | 32.8 ± 14.71 | 32.2 ± 13.53 |

## (Statistical analysis of VLDL)

| | **Between I & II** (Basal & After 4wks of treatment) | **Between I & III** (Basal & After 12wks of treatment) | **Between I & V** (Basal & After 3 months of withdrawal) |
|---|---|---|---|
| 't' value | 0.255 | 0.832 | 0.463 |
| DF (degree of freedom | 15 | 13 | 12 |
| P value | >0.8 | >0.4 | >0.6 |
| Remark | Insignificant | Insignificant | Insignificant |

[Group A - Raw Garlic (LDL)]

| Result in mg/dl | | | | | | | |
|---|---|---|---|---|---|---|---|
| S.No. | Name | Age/ Sex | 1 (Basal) At Regis. | 2 4 week | 3 12 week | 4 1 month after withdrawal | 5 3 month after with-drawal |
| 1 | Puttan | 40/M | 184 | 154 | 136.8 | 151.6 | 163.2 |
| 2 | Premdubey | 46/F | 131 | 115.6 | 111.2 | - | - |
| 3 | Ragvendra Sharma | 68/M | 130 | 118.4 | - | - | 123.8 |
| 4 | Madan Mohan Soni | 41/M | 140 | 137 | 141 | 141 | 142.8 |
| 5 | Raja Bai | 52/F | 136 | 123 | - | - | - |
| 6 | Ram Rati | 40/F | 166 | 160.6 | - | - | - |
| 7 | Lila Devi | 60/F | 146 | 132 | 125.6 | 134.2 | 142.6 |
| 8 | Shanti Devi | 65/F | 109.8 | 111 | 110 | 116 | 116.4 |
| 9 | Dinesh Kumar Gupta | 43/M | 147 | - | 133.8 | - | - |
| Mean± SD | | 50.5± 10.6yrs | 143.3± 21.53 | 131.5± 18.13 | 126.4± 13.24 | 135.7± 15.00 | 137.8± 18.35 |

(Statistical analysis of LDL)

| | **Between I & II** (Basal & After 4wks of treatment) | **Between I & III** (Basal & After 12wks of treatment) | **Between I & V** (Basal & After 3 months of withdrawal) |
|---|---|---|---|
| 't' value | 1.210 | 1.708 | 0.480 |
| DF (degree of freedom | 15 | 13 | 12 |
| P value | >0.2 | >0.1 | >0.6 |
| Remark | Insignificant | Insignificant | Insignificant |

## [Group B -Garlic Pearls (STC)]

| Result in mg/dl | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 |
| S.No. | Name | Age/ Sex | (Basal) At Regis. | 4 week | 12 week | 1 month after withdrawal | 3 month after with-drawal |
| 1 | SA Kadri | 42/M | 188 | 186 | 181 | 185 | 186 |
| 2 | M Barua | 45/F | 217 | 212 | 210 | 212 | 215 |
| 3 | Sunil Kumar | 35/M | 200 | 188 | 182 | 187 | 211 |
| 4 | Hanuman Prasad | 66/M | 200 | 190 | - | - | - |
| 5 | Ashok Srivastava | 39/M | 205 | 181 | 176 | 180 | 190 |
| 6 | Kamta Prasad | 50/M | 257 | 240 | - | - | - |
| 7 | Chandra Shekar Diwedi | 52/M | 233 | 221 | 216 | - | - |
| 8 | Ramgopal Kushwaha | 50/M | 195 | 192 | 186 | 190 | 200 |
| 9 | Mr. Omar Mohammad | 60/M | 212 | 200 | 186 | 192 | 206 |
| Mean± SD | | 48.7± 9.8yrs | 211.8± 21.48 | 201.1± 19.49 | 191.0± 15.50 | 191.0± 11.09 | 201.3± 11.55 |

## (Statistical analysis of STC)

| | **Between I & II** (Basal & After 4wks of treatment) | **Between I & III** (Basal & After 12wks of treatment) | **Between I & V** (Basal & After 3 months of withdrawal) |
|---|---|---|---|
| 't' value | 1.11 | 2.101 | 1.088 |
| DF (degree of freedom | 16 | 14 | 14 |
| P value | >0.2 | 0.05 | 0.2 |
| Remark | Insignificant | Insignificant | Insignificant |

## [Group B - Garlic Pearls (STG)]

| Result in mg/dl | | | | | | | |
|---|---|---|---|---|---|---|---|
| S.No. | Name | Age/ Sex | 1 (Basal) At Regis. | 2 4 week | 3 12 week | 4 1 month after withdrawal | 5 3 month after with-drawal |
| 1 | SA Kadri | 42/M | 200 | 200 | 173 | 180 | 180 |
| 2 | M Barua | 45/F | 152 | 117 | 107 | 110 | 117 |
| 3 | Sunil Kumar | 35/M | 170 | 156 | 133 | 140 | 133 |
| 4 | Hanuman Prasad | 66/M | 174 | 158 | - | - | - |
| 5 | Ashok Srivastava | 39/M | 258 | 228 | 180 | 192 | 210 |
| 6 | Kamta Prasad | 50/M | 117 | 117 | - | - | - |
| 7 | Chandra Shekar Diwedi | 52/M | 100 | 98 | 98 | - | - |
| 8 | Ramgopal Kushwaha | 50/M | 205 | 200 | 174 | 181 | 188 |
| 9 | Mr. Omar Mohammad | 60/M | 153 | 133 | 128 | 132 | 146 |
| Mean± SD | | 48.7± 9.8yrs | 169.8± 47.71 | 156.3± 44.71 | 141.8± 33.83 | 155.8± 32.99 | 162.3± 41.99 |

## (Statistical analysis of STG)

| | **Between I & II** (Basal & After 4wks of treatment) | **Between I & III** (Basal & After 12wks of treatment) | **Between I & V** (Basal & After 3 months of withdrawal) |
|---|---|---|---|
| 't' value | 0.619 | 1.313 | 0.312 |
| DF (degree of freedom | 16 | 14 | 13 |
| P value | >0.5 | >0.2 | >0.7 |
| Remark | Insignificant | Insignificant | Insignificant |

## [Group B - Garlic Pearls (HDL)]

| Result in mg/dl | | | | | | | |
|---|---|---|---|---|---|---|---|
| S.No. | Name | | 1 | 2 | 3 | 4 | 5 |
| | | Age/ Sex | (Basal) At Regis. | 4 week | 12 week | 1 month after withdrawal | 3 month after with-drawal |
| 1 | SA Kadri | 42/M | 45 | 42 | 42 | 42 | 44 |
| 2 | M Barua | 45/F | 40 | 45 | 45 | 45 | 44 |
| 3 | Sunil Kumar | 35//M | 42 | 45 | 45 | 45 | 43 |
| 4 | Hanuman Prasad | 66/M | 45 | 44 | - | - | - |
| 5 | Ashok Srivastava | 39/M | 45 | 45 | 48 | 48 | 46 |
| 6 | Kamta Prasad | 50/M | 43 | 45 | - | - | - |
| 7 | Chandra Shekar Diwedi | 52/M | 43 | 45 | 45 | - | - |
| 8 | Ramgopal Kushwaha | 50/M | 46 | 45 | 45 | 44 | 44 |
| 9 | Mr. Omar Mohammad | 60/M | 44 | 45 | 45 | 45 | 44 |
| Mean± SD | | 48.7± 9.8yrs | 43.6± 1.87 | 44.5± 1.01 | 45.0± 1.73 | 44.8± 1.94 | 44.2± 0.98 |

## (Statistical analysis of HDL)

| | **Between I & II** (Basal & After 4wks of treatment) | **Between I & III** (Basal & After 12wks of treatment) | **Between I & V** (Basal & After 3 months of withdrawal) |
|---|---|---|---|
| 't' value | 1.271 | 1.535 | 0.716 |
| DF (degree of freedom | 16 | 14 | 13 |
| P value | >0.2 | >0.1 | >0.4 |
| Remark | Insignificant | Insignificant | Insignificant |

[Group B - Garlic Pearls (VLDL)]

| Result in mg/dl | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 |
| S.No. | Name | Age/ Sex | (Basal) At Regis. | 4 week | 12 week | 1 month after withdrawal | 3 month after with-drawal |
| 1 | SA Kadri | 42/M | 40 | 40 | 35 | 36 | 36 |
| 2 | M Barua | 45/F | 30 | 23.4 | 21 | 22 | 23.4 |
| 3 | Sunil Kumar | 35/M | 34 | 31 | 27 | 28 | 27 |
| 4 | Hanuman Prasad | 66/M | 35 | 31.6 | - | - | - |
| 5 | Ashok Srivastava | 39/M | 51 | 45.6 | 36 | 38.4 | 42 |
| 6 | Kamta Prasad | 50/M | 23 | 23 | - | - | - |
| 7 | Chandra Shekar Diwedi | 52/M | 20 | 19.6 | 19.6 | - | - |
| 8 | Ramgopal Kushwaha | 50/M | 41 | 40 | 34.8 | 36.2 | 37.6 |
| 9 | Mr. Omar Mohammad | 60/M | 30.6 | 26.6 | 25.6 | 26.4 | 29.2 |
| Mean± SD | | 48.7± 9.8yrs | 33.8± 9.48 | 31.2± 8.98 | 28.4± 6.88 | 31.2± 6.6 | 32.5± 7.10 |

(Statistical analysis of VLDL)

| | **Between I & II** (Basal & After 4wks of treatment) | **Between I & III** (Basal & After 12wks of treatment) | **Between I & V** (Basal & After 3 months of withdrawal) |
|---|---|---|---|
| 't' value | 0.597 | 1.285 | 0.288 |
| DF (degree of freedom | 16 | 14 | 13 |
| P value | >0.5 | >0.2 | >0.7 |
| Remark | Insignificant | Insignificant | Insignificant |

## [Group B – Garlic Pearls (LDL)]

| Result in mg/dl | | | | | | | |
|---|---|---|---|---|---|---|---|
| S.No. | Name | | 1 | 2 | 3 | 4 | 5 |
| | | Age/ Sex | (Basal) At Regis. | 4 week | 12 week | 1 month after withdrawal | 3 month after with-drawal |
| 1 | SA Kadri | 40/M | 103 | 104 | 104 | 107 | 106 |
| 2 | M Barua | 45/F | 147 | 143.6 | 144 | 145 | 147.6 |
| 3 | Sunil Kumar | 35/M | 124 | 112 | 110 | 114 | 141 |
| 4 | Hanuman Prasad | 66/M | 120 | 114.4 | - | - | - |
| 5 | Ashok Srivastava | 39/M | 109 | 90.4 | 92 | 93.6 | 102 |
| 6 | Kamta Prasad | 50/M | 191 | 172 | - | - | - |
| 7 | Chandra Shekar Diwedi | 52/M | 170 | 156.4 | 151.4 | - | - |
| 8 | Ramgopal Kushwaha | 50/M | 108 | 107 | 106.2 | 108.8 | 118.4 |
| 9 | Mr. Omar Mohammad | 60/M | 137.4 | 128.4 | 115.4 | 120.6 | 132.8 |
| Mean± SD | | 48.7± 9.8yrs | 134.4± 30.17 | 125.4± 26.97 | 117.6± 21.87 | 114.8± 17.27 | 124.6± 18.76 |

## (Statistical analysis of LDL)

| | **Between I & II** (Basal & After 4wks of treatment) | **Between I & III** (Basal & After 12wks of treatment) | **Between I & V** (Basal & After 3 months of withdrawal) |
|---|---|---|---|
| 't' value | 0.667 | 1.449 | 0.705 |
| DF (degree of freedom | 16 | 14 | 13 |
| P value | >0.5 | >0.1 | >0.4 |
| Remark | Insignificant | Insignificant | Insignificant |

## [Group C – Simvastatin (STC)]

| Result in mg/dl | | | | | | | |
|---|---|---|---|---|---|---|---|
| S.No. | Name | Age/ Sex | 1 (Basal) At Regis. | 2 4 week | 3 12 week | 4 1 month after withdrawal | 5 3 month after with-drawal |
| 1 | Sunil Khattar | 53/M | 200 | 194 | 162 | 164 | 176 |
| 2 | Laxmi Bai | 60/F | 200 | 196 | 176 | 200 | 240 |
| 3 | Prabhudayal Yadav | 40/M | 228 | 212 | 188 | - | - |
| 4 | Santosh Jain | 42/M | 217 | 210 | 200 | 202 | 206 |
| 5 | Meera Bai | 36/F | 211 | 200 | 186 | - | - |
| 6 | Harnarayan | 50/M | 200 | 180 | 172 | 183 | 186 |
| 7 | D.C. Puneet | 68/M | 200 | 200 | 194 | 200 | 217 |
| 8 | K.V. Nayak | 44/M | 200 | 200 | 194 | - | 196 |
| 9 | Shivdayal | 42/M | 216 | 190 | 190 | 194 | 197 |
| Mean± SD | | 48.3± 10.4yrs | 208.0± 10.45 | 198.0± 9.8 | 184.6± 12.24 | 190.5± 14.72 | 202.6± 21.11 |

## (Statistical analysis of STC)

| | **Between I & II** (Basal & After 4wks of treatment) | **Between I & III** (Basal & After 12wks of treatment) | **Between I & V** (Basal & After 3 months of withdrawal) |
|---|---|---|---|
| 't' value | 2.082 | 4.365 | 0.673 |
| DF (degree of freedom | 16 | 16 | 14 |
| P value | >0.05 | <0.001 | >0.5 |
| Remark | Insignificant | Very significant | Insignificant |

## [Group C - Simvastatin (STG)]

| Result in mg/dl | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 |
| S.No. | Name | Age/ Sex | (Basal) At Regis. | 4 week | 12 week | 1 month after withdrawal | 3 month after with-drawal |
| 1 | Sunil Khattar | 53/M | 360 | 288 | 184 | 210 | 270 |
| 2 | Laxmi Bai | 60/F | 132 | 120 | 122 | 120 | 120 |
| 3 | Prabhudayal Yadav | 40/M | 280 | 275 | 240 | - | - |
| 4 | Santosh Jain | 42/M | 272 | 218 | 190 | 196 | 212 |
| 5 | Meera Bai | 36/F | 320 | 260 | 187 | - | - |
| 6 | Harnarayan | 50/M | 144 | 138 | 133 | 133 | 140 |
| 7 | D.C. Puneet | 68/M | 233 | 198 | 160 | 140 | 107 |
| 8 | K.V. Nayak | 44/M | 140 | 134 | 127 | - | 130 |
| 9 | Shivdayal | 42/M | 136 | 134 | 126 | 128 | 130 |
| Mean± SD | | 48.3± 10.4yrs | 224.1± 88.66 | 196.1± 67.19 | 163.2± 40.10 | 154.5± 42.09 | 158.4± 55.30 |

## (Statistical analysis of STG)

| | **Between I & II** (Basal & After 4wks of treatment) | **Between I & III** (Basal & After 12wks of treatment) | **Between I & V** (Basal & After 3 months of withdrawal) |
|---|---|---|---|
| 't' value | 0.751 | 1.877 | 1.680 |
| DF (degree of freedom | 16 | 16 | 14 |
| P value | >0.4 | >0.05 | >0.1 |
| Remark | Insignificant | Insignificant | Insignificant |

[Group C - Simvastatin (HDL)]

| Result in mg/dl | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 |
| S.No. | Name | Age/ Sex | (Basal) At Regis. | 4 week | 12 week | 1 month after withdrawal | 3 month after with-drawal |
| 1 | Sunil Khattar | 53/M | 52 | 55 | 57 | 55 | 55 |
| 2 | Laxmi Bai | 60/F | 55 | 55 | 55 | 55 | 54 |
| 3 | Prabhudayal Yadav | 40/M | 45 | 42 | 48 | - | - |
| 4 | Santosh Jain | 42/M | 48 | 49 | 50 | 45 | 45 |
| 5 | Meera Bai | 36/F | 59 | 60 | 61 | - | - |
| 6 | Harnarayan | 50/M | 40 | 42 | 42 | 45 | 45 |
| 7 | D.C. Puneet | 68/M | 45 | 45 | 48 | 45 | 45 |
| 8 | K.V. Nayak | 44/M | 42 | 42 | 44 | - | 40 |
| 9 | Shivdayal | 42/M | 48 | 49 | 49 | 47 | 47 |
| Mean± SD | | 48.3± 10.4yrs | 48.2± 6.7 | 48.8± 6.66 | 50.4± 6.14 | 48.6± 4.99 | 47.3± 5.38 |

(Statistical analysis of HDL)

| | **Between I & II** (Basal & After 4wks of treatment) | **Between I & III** (Basal & After 12wks of treatment) | **Between I & V** (Basal & After 3 months of withdrawal) |
|---|---|---|---|
| 't' value | 0.198 | 0.758 | 0.307 |
| DF (degree of freedom | 16 | 16 | 14 |
| P value | >0.8 | >0.4 | >0.7 |
| Remark | Insignificant | Insignificant | Insignificant |

[Group C - Simvastatin (VLDL)]

| Result in mg/dl | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 |
| S.No. | Name | Age/ Sex | (Basal) At Regis. | 4 week | 12 week | 1 month after withdrawal | 3 month after with-drawal |
| 1 | Sunil Khattar | 53/M | 72 | 57 | 36 | 42 | 54 |
| 2 | Laxmi Bai | 60/F | 26.4 | 24 | 24.4 | 24 | 24 |
| 3 | Prabhudayal Yadav | 40/M | 56 | 55 | 48 | - | - |
| 4 | Santosh Jain | 42/M | 54 | 43.6 | 38 | 39.2 | 43 |
| 5 | Meera Bai | 36/F | 64 | 52 | 37.4 | - | - |
| 6 | Harnarayan | 50/M | 29 | 28 | 27 | 27 | 28 |
| 7 | D.C. Puneet | 68/M | 47 | 39.6 | 32 | 28 | 21.0 |
| 8 | K.V. Nayak | 44/M | 28 | 26.8 | 25 | - | 26 |
| 9 | Shivdayal | 42/M | 27 | 26.8 | 25.2 | 25.6 | 26 |
| Mean± SD | | 48.3± 10.4yrs | 44.8± 17.72 | 39.2± 13.29 | 32.5± 8.00 | 30.9± 7.63 | 31.7± 12.09 |

(Statistical analysis of VLDL)

| | **Between I & II** (Basal & After 4wks of treatment) | **Between I & III** (Basal & After 12wks of treatment) | **Between I & V** (Basal & After 3 months of withdrawal) |
|---|---|---|---|
| 't' value | 0.767 | 1.901 | 1.673 |
| DF (degree of freedom | 16 | 16 | 14 |
| P value | >0.4 | >0.05 | >0.1 |
| Remark | Insignificant | Insignificant | Insignificant |

## [Group C - Simvastatin (LDL)]

| Result in mg/dl | | | | | | | |
|---|---|---|---|---|---|---|---|
| S.No. | Name | | 1 | 2 | 3 | 4 | 5 |
| | | Age/ Sex | (Basal) At Regis. | 4 week | 12 week | 1 month after withdrawal | 3 month after with-drawal |
| 1 | Sunil Khattar | 53/M | 76 | 82 | 69 | 67 | 67 |
| 2 | Laxmi Bai | 60/F | 118.6 | 117 | 96.6 | 121 | 162 |
| 3 | Prabhudayal Yadav | 40/M | 127 | 115 | 92 | - | - |
| 4 | Santosh Jain | 42/M | 115 | 117.4 | 112 | 117.8 | 118 |
| 5 | Meera Bai | 36/F | 97 | 88 | 87.6 | - | - |
| 6 | Harnarayan | 50/M | 131 | 108 | 103 | 110 | 113 |
| 7 | D.C. Puneet | 68/M | 108 | 115.4 | 114 | 127 | 151.0 |
| 8 | K.V. Nayak | 44/M | 130 | 131.2 | 125 | - | 130 |
| 9 | Shivdayal | 42/M | 141 | 114.2 | 115.8 | 121.4 | 124 |
| Mean± SD | | 48.3± 10.4yrs | 115.9± 19.99 | 109.8± 15.39 | 101.7± 17.28 | 110.7± 22.12 | 123.6± 30.58 |

## (Statistical analysis of LDL)

| | **Between I & II** (Basal & After 4wks of treatment) | **Between I & III** (Basal & After 12wks of treatment) | **Between I & V** (Basal & After 3 months of withdrawal) |
|---|---|---|---|
| 't' value | 0.725 | 1.611 | 0.609 |
| DF (degree of freedom | 16 | 16 | 14 |
| P value | >0.4 | >0.1 | >0.5 |
| Remark | Insignificant | Insignificant | Insignificant |